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Editor's Comments

THIS issue of *The Neptune* returns to our normal format of contributions covering a wide spectrum of maritime history. We begin with an article by Philip K. McLaughlin entitled 'Blockading the New England Coast.' This describes how our new nation found itself virtually defenseless when faced by British seapower during the early years of our existence. It is followed by Lionel Casson's masterly summation of the present state of our knowledge of the ancient classical world's shipbuilding techniques in a piece called 'Greek and Roman Shipbuilding: New Findings.' Next comes Richard Crighton's 'The Wreck of *San Francisco*,' in which we find an interesting presentation of a major nineteenth-century sea disaster.

Spencer C. Tucker then continues with an important study of early U.S. naval ordnance, entitled 'Arming the Fleet: Early Cannon Founders to the U.S. Navy.' This is followed by a fifth article which examines how maritime history is being taught by describing the program which Mystic Seaport has offered for more than two decades, making it a leading national center for the study of our maritime heritage. This is a survey of The Frank Munson Institute written by its present director, Benjamin Labaree. Last of all, we have a naval expert's view of that crucial year in the battle of the Atlantic during which German U-boats finally began to lose out to Allied naval forces. This article by David Syrett, called 'The Battle of the Atlantic: 1943, the Year of Decision,' is a must for all those who wish to understand the naval side of World War II.

Our issue then is completed with a list of new maritime exhibits being mounted by North American museums during 1985 and an index covering the 1984 issues of *The Neptune* itself.

We also wish to call the attention of our readers to an important article appearing in the December issue of *The Smithsonian* by Neil Hollander and Harold Mertes, called 'Sunset for Working Sail.' It contains remarkable pictures of sailing vessels from remote parts of the seven seas which are rapidly disappearing from the scene. The photographs and text in this article are from a recently published book, *The Last Sailors* (St. Martin's Press), which many of you may wish to own.

Finally, may we wish all our subscribers and friends a New Year which we hope will see our journal continue to interest a wide circle of discriminating readers who are concerned with our maritime past.

ARCHIBALD R. LEWIS

Salem, Massachusetts

Blockading the New England Coast: The Journal of Lt. Henry Napier

BY PHILIP K. MCLAUGHLIN

'BEGIN with a dollar and proceed to any amount, you may always buy a Yankee in almost any rank and station! They are a young nation but venality flourishes in the utmost luxuriance!'

So wrote Lt. Henry Edward Napier, a young and obviously opinionated British naval officer who, during the War of 1812, while aboard the frigate HMS *Nymphe* on blockade duty off the Massachusetts coast from March to August 1814, kept a lively, occasionally fascinating journal of the day-to-day doings of the Royal Navy on blockade. Napier was a meticulous observer who carefully recorded not merely the bare facts, but also his thoughts and impressions. He was, at least in the privacy of his own journal, critical of his superiors and of the general conduct of the blockade, and he had some very definite convictions about New Englanders.

Frequent and close contacts with the local population, through seizures of vessels and foraging expeditions on shore, gave Napier ample opportunity to form his often-caustic opinions of his Yankee enemies. The well-known antipathy of many New Englanders to what they termed 'Mr. Madison's war,' or the 'useless war,' and the apparent friendliness often shown to the blockading British, prompted Napier to observe that the Yankee Federalists 'hate the war on their own account, hate the war because it prevents their making money, and like the English as a spendthrift loves an old rich wife; the sooner we are gone the better.'

Indeed, the local Yankees often behaved with remarkable openhandedness to their enemies, and with somewhat less than fanatical dedication to the national cause. On one occasion fishermen in Boston Bay informed the captain of *Nymphe* that USS *Constitution*—'Old Ironsides'—was 'stripped and refitting in Boston Harbour,' and that USS *Congress*, at Portsmouth, New Hampshire, was ready for sea. On another occasion, the editor of a Boston newspaper boarded *Nymphe* 'to see the ship'; other curious visitors included the selectmen of the Cape Cod towns of Truro, Provincetown, and Wellfleet. On 31 May, under a flag of truce, a shore party from *Nymphe* in and around Wellfleet Bay purchased stock, 'which the inhabitants were very willing to supply . . . being very well paid,' while, off Boston in early July, the crew of *Nymphe* 'received green peas and fruit with stock of all kinds, books and newspapers, wet from the press, by our friends here.'

If Napier disliked the venality and hypocrisy he detected in many Yankees, he reserved some of his severest contempt for the fair ladies of Salem, Massachusetts. On 20 July, Napier and some others from *Nymphe*, under a flag of truce, anchored off Fort Pickering and sent ashore a letter from the ship's commander, Captain Epworth, inquiring about the possible exchange of several prisoners. Napier observed that several ladies came to see 'whether Englishmen were Christians or Devils.' Unfortunately for the devotee of colorful New England historical trivia, Napier's usually scrupulously specific journal fails in its attention to detail, for whatever these Salem ladies had to say so shocked the young British officer that he was moved to exclaim, 'The ladies on this coast are infinitely more violent than the males, perfect Amazons!'

Napier's amusing views of self-serving Yankee businessmen and the violent New England Amazons are entirely understandable, given the circumstances in which he found himself. He was, after all, the declared enemy of those Yankees, forced, on their account, to beat up and down along a rocky, inhospitable shore, alternately fired upon by patriotic belligerents or bombarded with bribes and self-serving gifts by Yankee sycophants. Less understandable, and therefore more remarkable, are the frequent humanitarian concern and plain old kindness shown toward these Yankee enemies by Napier and the officers and crew of *Nymphe*.

A fine example of this kindness and concern involved three schoolmistresses aboard the schooner

Three Sisters, which, while sailing from Mount Desert, Maine, to New London, Connecticut, had been overtaken and captured by *Nymphe*. The good citizens of Mount Desert, who, unlike so many of their Yankee compatriots, were 'unacquainted with money,' had paid the three teachers their twelve months' wages in wooden shingles, which the women hoped to sell in New London for seventy-five dollars, their year's pay. Interestingly, Napier's journal contains a definition of the term *shingle,* an object apparently unknown in Great Britain.

Unfortunately, the requirements of war forced Captain Epworth to burn *Three Sisters,* and along with it the three schoolmistresses' shingles. Napier wrote, 'The three women excessively sick. What with misfortunes and sea-sickness they are really to be pitied.' The story has a happy ending, however, one best related in Napier's own words:

> On the twelfth blowing weather from the southward. The fair prisoners (one very pretty) much better and more reconciled to their situation on being assured they would be sent on shore in the first fishing boat. The master of the *Three Sisters* gives a deplorable account of the wretched state of trade throughout the States since the war. P.M. Called a fishing boat alongside and sent the women on shore to their great delight, particularly as the Captain and officers made up by subscription nearly the amount of their loss.

Passing the hat in order to make good an enemy's loss, regardless of how pretty that enemy might be, is an unusual wartime practice, indeed; however, on other occasions, Napier and his crewmates exhibited similar, if less extraordinary consideration toward their opponents. At Annisquam, Napier burned two American vessels, but left a third unharmed 'because she belonged to an old man who had a wife and eight children and had lost $20,000 within two years. Destroying this, his last,' Napier commented, 'would have ruined him.' Another vessel, *Federalist,* was spared, and Napier humorously suggested that its name justified the act of mercy toward the ship; later in the journal, Napier explained his true motive in sparing *Federalist:*

> the truth is she was aground alongside of the town and I could neither get her off, or set fire to her there, without burning a number of poor people's houses. These little things, when constantly done, may cause distrust, or heighten that which has already broken out with great violence between parties.

At one point, Napier's sympathy for many of his Yankee enemies prompted an angry and emotional journal entry that reveals Napier's character and his genuine and very unmilitary feelings about the war. In Cape Cod Bay, *Nymphe* seized an American fishing craft and held it in exchange for two hundred dollars in ransom. The owner/fisherman, who had a wife and seven children, was very poor, 'in debt for his salt and fishing lines,' but managed 'by sixpences and shillings' to glean the necessary amount. Returning to *Nymphe* from Provincetown 'with tears in his eyes,' the unfortunate fisherman redeemed his boat. Smarting from the insensitivity of his captain in this case, Napier wrote, 'This is an ungenerous war against the poor and unworthy of Englishmen. I am ashamed of Captain Epworth's conduct.'

Throughout his journal, Napier's gentle and generous character, his warmth and humanity, and his admiration of true nobility in all persons, whether of high or low station, friend or foe, shine through his written words. On Cape Anne foraging for cattle, Napier and his landing party were confronted by 'a fine little girl' who ran out and rescued her flock of sheep from the marauding British seamen. She 'very gallantly came and drove them away in the face of about eighteen armed men and a great gun.' Napier was sincerely impressed by the courage and defiance of this unknown heroine. He commented that 'very few females, or even boys, would have done this, which shewed as much goodness of heart as intrepidity of mind.'

Napier's manly admiration for noble enemies even included Napoleon, the arch-enemy of Britain:

> News of peace on the continent of Europe and the abdication of Napoleon. What astonishing events! Has he, or has he not, acted like a great man? I certainly thought he would not have survived his dethronement. Perhaps he may be reserved for more extraordinary events, for this is an age of wonders!

An age of wonders, indeed; and not the least among them was this young British naval officer. It should be noted that Napier was a member of an illustrious British military family; his father was a colonel in the British army, and three of his brothers became generals. Napier was born in 1789, at the beginning of the French Revolution, and lived through the period of England's greatest peril. Yet, Henry Edward Napier could think of Napoleon as a 'great man,' and could

spare the property of an enemy because of that enemy's need.

A further indication of Napier's gentle and unmilitary character was his interest in poetry; his entry for 21 June included the comment that he had just finished reading Lord Byron's *The Corsair*, which, Napier observed, was 'extremely interesting and well written but perhaps the poetry is not so fine as that of *The Giaour*.'

Perhaps Napier's sensitive and poetic disposition ill-suited him for a career in the Royal Navy, for self-doubt, self-criticism, and sympathy towards one's enemies are not the stuff of which great military leaders are made. Reflecting upon the failure of Captain Epworth to return a ransom he had promised to return, a failure apparently generated by greed for prize money, Napier wrote:

> This is bad! Indeed there has been a very great *carelessness* of *good faith* in Boston Bay for some weeks. . . . The false glitter of a few dollars will so dazzle the eyes of well-disposed but weak people as completely to eclipse the milder but more nourishing light of Justice, Honour and Self-approval. How very long one may be living on even intimate terms with people without discovering their true character, not because they take any pains to conceal it, but, like sympathetic ink, it requires the proper heat, the exciting cause to produce it in its proper colours. Perhaps, the absence of that very cause prevents me at this moment from knowing my own!

It is noteworthy that Napier questioned his own deep motives in his Byronic outburst. He continued, 'The latent seeds of every kind of evil may be within me, ready to spring into vegetation whenever a change of climate more congenial to this growth may give them strength to shoot.'

Although the effects of greed were of greatest concern to Napier, the possible corruption wrought by advancement also occupied his thoughts. Betraying his negative feelings about Captain Epworth, Napier observed, 'There appears to be a kind of magic in a second epaulette which attracts attention, whatever bar there may be on the shoulders under. I already see the effect rank has, or rather feel it, but I hope I shall never imitate, or be seduced by it.'

Both the character of the blockade, with its harmful effects most visible in the deprivation it visited upon the civilian population, and the duality and conflicting attitudes shown by New Englanders toward 'the useless war,' and toward the British, must have proven almost constant violations to Napier's scrupulous moral temperament. He was justifiably outraged by an incident off Plymouth involving *Nymphe*'s pinnace. Venturing too close to the batteries at Plymouth, the pinnace had been holed by a shot. The crew 'hauled their colours down and hoisted them Union downward,' but the American battery continued firing; the pinnace crew then rehoisted the colours, 'Union upwards,' and the unlucky boat 'went down with flying colours.' The nineteen crewmen escaped unhurt, but as the pinnace sank, the Americans 'in a most infamous manner continued still a well-directed fire at the people when in the water,' and even fired at the boats sent to rescue the swimming seamen.

Two days later, at Scituate, Massachusetts, in company with the ship-of-the-line, HMS *Bulwark*, *Nymphe* retaliated by burning about thirty-five vessels, sparing only one, whose owner had rendered services to the marauding British boats. Napier, far from feeling gratitude toward the helpful Yankee, saw him merely as 'a Democrat and a traitor,' and wondered whether 'it is right to keep one's word' or if 'the destruction of such a rascal would not almost justify its being broken.'

Incidentally, this foray into Scituate in revenge for the attack on *Nymphe*'s pinnace at Plymouth set the stage for the well-known heroics of Rebecca and Abigail Bates, the 'army of two,' who, several months later, according to local New England legend, drove off several boatloads of Royal Marines by marching up and down by the Scituate lighthouse playing 'Yankee Doodle' on a fife and drum left behind by local militiamen.

A week after the raid on Scituate, *Nymphe* captured an American vessel, *Polly*, whose master, from Northport, Maine, rankled Napier's sensitivities even more than the rascally Democrat at Scituate. The master of *Polly* was dealing illicitly in government stores, and Napier felt that both the master, and the Boston merchant with whom he was dealing, 'for the value of a few dollars . . . forfeit their honour as men, their fidelity to their country and morality as Christians.' Concerning the crooked shipmaster, Napier added, 'My hope and prophecy is that he will be hung before his next birthday.'

It must have given Napier great delight to make his journal entry for 21 June, two days after the master of *Polly* had been released by Captain Epworth:

Our friend, the master of the *Polly*, was suspected and seized on his landing at Gloucester, examined and committed his trial at the next sessions with full proof of his iniquity, thus fulfilling my prophecy he deserves to be hanged for being a most consummate fool in addition to his other good qualities.

Greed in other Americans was apparently a never-ending source of humor for Napier and his crewmates. Along Cape Cod in late July, again on a foraging expedition, *Nymphe* was visited by a 'deputation of Quakers' who earnestly advised the British to 'go a little further to the southward and . . . be supplied with much fatter and better cattle.'

Yankee Quakers did not fare too well at the hands of the Royal Navy. At Nantucket Island, one of the mates from *Nymphe*, Charles Goullett, raiding along the coast in the ship's tender, received a fascinating letter, included in its entirety in Napier's journal:

To Charles Goullett at Sea

Respected Friend Charles Goullett, Nantucket, 7 Month 16.

On behalf and by request of Richd. Mitchell, Jethro' Mitchell and others, including myself, I may inform thee that we are of the people called Quakers and of the discription of Pease makers and have not at any period been enemies to Great Brittain and her dependencies, neither have we in any point injured her subjects. In consequence we feal imboldened to solicit thy lenity towards the Inhabitance, being perswaided that the well informed and most correct part of the Inhabitance are solicitous and ever have been for Pease with G. Brittain. I feel in hopes that thou wilt find it consistant with thy standing to comply with us our request but not being acquainted with thy duty in a publick line, I must submit the subject. I am thy assured friend

Obediah Mitchell

Goullett responded with a letter of his own, parodying Obediah's effort in high style, a style which suggests that British letters suffered an irredeemable loss when the witty Mr. Goullett chose a career in the navy:

Respected Friend Obediah Mitchell, 7th Month (not encreased).

Having in due course received thy communication, making known unto me that thou art of the description of pease makers called Quakers, I forthwith acquaint thee that I am of the description of pease breakers called Sailors, and being at this present time in extreme want of materials to supply my calling, I must pray and beseech thee, Obediah, immediately to cause to be sent unto this, my sloop, at sea four bushels of the said pease, of the colour usually denominated green, and of the description known by the appellation young, and as further inducement to thee, Friend Obediah, to comply with this my request, be it known unto thee that the sloop *Mariner* is at present one of the dependencies of Great Britain, of which thou has said 'thou wast never an Enemy,' and it being a known rule of thy sect to succour the unfortunate, more particularly friends in distress, I trust thou will let the Milk of Human Kindness flow freely from thee, and should it to my unconscious eyes assume the appearance of cow's milk, and thee, Obediah, the plain and upright pail that holds it, even then, respected friend, I should not be offended!

I remain with assured respect

Charles Goullett

In June, Goullett's letter-writing had created a furor in Boston. Again commanding the tender, Goullett had sailed right into Boston Harbor at night, burned a sloop within a mile of 'Old Ironsides,' and then made a grand tour of the area. He also sent a note to the editor of the *Boston Patriot*, boasting that he had 'made myself sufficiently acquainted with the strength and navigation of your port,' and warning 'Com. Bainbridge to place the *Constitution* in the best possible state of defence.'

The *Patriot* seized upon the incident to lambaste Federalist Governor Caleb Strong, prompting the *Boston Gazette* to defend Strong, accuse the *Patriot* of fabricating the letter, and blame 'our *National* Rulers' for the 'defenceless state of our seaports.' The feud continued unabated for some time, undoubtedly to the gratification and amusement of Goullett, Napier, and the crew of *Nymphe*.

Goullett's letter, the infrequent exchange of a few shots with an American shore battery, and an occasional foraging expedition ashore were the exceptional breaks in an otherwise mundane routine. Napier's journal is filled with comments on New England weather, with tales of sails sighted and lost, with stories of chases that ended in frustration. Yet, even some of these commonplaces have their interest. Napier chafed at learning that he had narrowly missed capturing Elbridge Gerry, a signatory of the Declaration of Independence, the vice-president of the United States, and the eponymous source of the term *gerrymander;* Gerry had been aboard a 'fishing pleasure boat' Napier had sighted, but let pass unmolested, inside Boston Harbor.

On the same excursion during which he had sighted Gerry's boat, Napier had seized another fishing vessel

and used her on a search for an armed coaster. A fresh wind came up, and 'being unused to the motion of a fishing boat,' Napier and his hardy British seamen became seasick! Or, perhaps, some of those supposedly friendly Yankees had engaged in a little gastronomic sabotage, after all.

Napier, like many a tourist since, was impressed by the Cape Cod lobster; he observed, 'The lobsters are remarkably large in Cape Cod Bay, and vessels come in numbers from New York and the southward. They fetch a good market.' He was similarly struck by the 'extraordinary shell fish,' the horseshoe crab, apparently unknown in Britain, and, on another occasion, while within one mile of Boston Light, saw *Constitution* 'nearly unrigged,' as whales, 'enjoying the fine weather as much as ourselves,' frolicked at the entrance to Boston Harbor.

Nothing could better indicate the alarmingly close, but seemingly routine contact the Royal Navy had with the New England coast, and the vulnerability of New England towns, as Napier's entry for 10 May 1814: 'Stood close in to the little town of Cape Anne or Gloucester, and regulated our watches by the town clock, which wanted ten minutes to eleven.'

On Saturday, 13 August 1814, Napier, previously promoted to the rank of captain, left *Nymphe* to assume his own command. He never again returned to duty off New England, and ended an unremarkable naval career in 1830, at the age of forty-one. Apart from his naval career, the major accomplishment of Napier's life was his six-volume history of Florence, published in 1846, and impressively entitled *Florentine History from the earliest authentic records to the accession of Ferdinand the Third, Grand Duke of Tuscany*.

Napier died in London on 13 October 1853, survived by his six-volume behemoth and his slim journal of 1814, which is an interesting and appealing minor footnote to New England history.

Philip McLaughlin is a teacher in the Boston Public School System. He is writing a book on the stereotyping of the Irish in popular American culture during the nineteenth century.

Greek and Roman Shipbuilding: New Findings

By Lionel Casson

In the history of naval technology, one chapter had long been missing: Greek and Roman shipbuilding; for centuries we knew hardly anything about it.[1] Then, with the advent of SCUBA diving in the years after World War II, the situation changed dramatically. There came into being a new branch of archaeology, underwater archaeology, which concentrated on the locating and examining of ancient wrecks. It so happens that wine, oil, and certain other commodities which were prime objects of trade among the Greeks and Romans were shipped in big clay jars—amphoras, to give them their technical name—and clay being well-nigh indestructible, these can last for centuries even on the sea floor. Divers soon became aware that a pile of them signalled the presence of an ancient wreck. And, when they began the actual excavation of wrecks, a welcome surprise awaited them: upon removing the jars, they frequently found still intact the part of the hull on which the amphoras had been stacked; these had protected it from the activity of sand and water and other factors that destroyed whatever parts were exposed. And this in turn yielded another surprise: Greek and Roman shipwrights, it seemed, had their own very special way of building a boat. In 1964 I presented in this journal a review of what was known at that time.[2] The twenty years since have filled in some gaps and added much welcome detail.

There are, basically, two ways to build a wooden boat. The way that has been standard in the west from the Middle Ages onward begins with the setting up of a skeleton consisting of a spine of keel and stempost and sternpost and a cage of ribs, or frames as they are called in shipwrights' parlance; then, to this is fastened a smooth skin of planks. The other, favored along many coasts of Asia, some parts of northern Europe, and certain other regions, is just the reverse: first a shell of planks is erected by pinning each plank to its neighbors; then a certain amount of framing is inserted to stiffen the shell (fig. 1).

The shipwright who starts with a shell of planks may join these to each other in any of three ways. One, best known to us because of its widespread use in northern Europe, produced the clinker-built boat: each plank overlaps the one below for a certain distance, and pegs, nails, or rivets driven through where the thickness is double hold the two together (fig. 1). In the other two methods the planks are set edge to edge to form a smooth skin; what differs is the means for fastening. In waters from the east coast of Africa to India, for example, the planks are sewn to one another with twine. In eastern Pakistan, areas of India and Egypt, and certain other places, the planks are pegged together, stapled together, or nailed together. Whichever system is used, the frames are always inserted later. And they are not necessarily of any great strength. Sometimes the number depends simply upon how much money a shipwright wants to spend; sometimes he will add to the original number of frames in a boat that has seen long use and whose shell has started to weaken.[3]

From an early age on, the Mediterranean knew the sewn boat, and ancient Egyptians by the third millennium B.C. had learned to build craft of edge-joined planks by dowelling these to each other or dowelling and sewing them. The great advance, however, was made by Greeks and Romans: their shipwrights developed a method all their own, one so refined that it more resembles cabinet work than carpentry. This seemed to be the case in 1964, when I first wrote about it; today, thanks to the discovery and examination of well over a score of ancient wrecks, we are absolutely sure of it. Like Egyptian shipwrights, they too started by building up a shell of planks. But, instead of using

1. The following abbreviations have been used: *AS* = P. Gianfrotta and P. Pomey, *Archeologia subacquea* (Milan, 1981); *IJNA* = *International Journal of Nautical Archaeology*; *MM* = *Mariner's Mirror*; *SSAW* = L. Casson, *Ships and Seamanship in the Ancient World* (Princeton, 1971); Steffy = J. R. Steffy, 'The reconstruction of the eleventh century Serçe Liman vessel,' *IJNA* 11 (1982), 13-34.

2. *The American Neptune* 24 (1964), 84-94.

3. *SSAW*, pp. 201-2.

Fig. 1 A Swedish boatwright, having completed his clinker-built shell, is ready to insert the frames.
Photo (1929) from the archive of the Göteborg Historical Museum through the courtesy of O. Hasslöf.

casual joinery, they locked the planks together with thousands of closely set mortise and tenon joints (fig. 2). Then, into this tightly knit structure they inserted framing, at times as complete as that in hulls made with a pre-erected skeleton. They used this impressive method not only for their big seagoing craft but for all sizes down to mere skiffs.

Their first step, inevitably, was to set up stocks and lay a keel. Then they added stempost and sternpost and perhaps a number of temporary mold frames to guide them in giving the shell the proper lines. Their very next step was to begin on the planking, fixing the garboard strakes into rabbets in the keel and edge-joining the succeeding strakes to each other with mortises and tenons (fig. 3). Sometimes they planked right up to the gunwales before inserting frames; sometimes they planked only a given distance up the sides, inserted some frames, and then resumed planking. The mortises and tenons that held the strakes edge to edge were generally some 5 cm broad, but they could run up to double that width; in depth they could penetrate halfway through the width of a plank (fig. 4). And they were, at least in well-built craft, consistently closely set: they were never placed more than 15 cm or so apart, most often they were but 5 or 10. Sometimes, by being staggered so that one was nearer the inboard surface and the next nearer the outboard, there was hardly any space at all between them (fig. 5). As a final measure, each joint was transfixed by a wooden peg to ensure its never coming apart (figs. 2, 4).[4]

To insert the frames, shipwrights scored lines on the inner surface of the shell showing where each was to go. On seagoing vessels they usually placed them no more than 25 cm apart and often much closer (fig. 6). Treenails driven through frame and planking held the frames in place; the treenails were often transfixed with bronze spikes to seat them absolutely solidly (fig. 7). Frequently spikes were used that were longer than the treenails, and the part that protruded beyond the inner face of the frame was clenched.[5]

This method of construction was costly. For one, it required time: shipwrights had to spend long hours

4. *SSAW*, pp. 202-6.
5. *SSAW*, pp. 206-8.

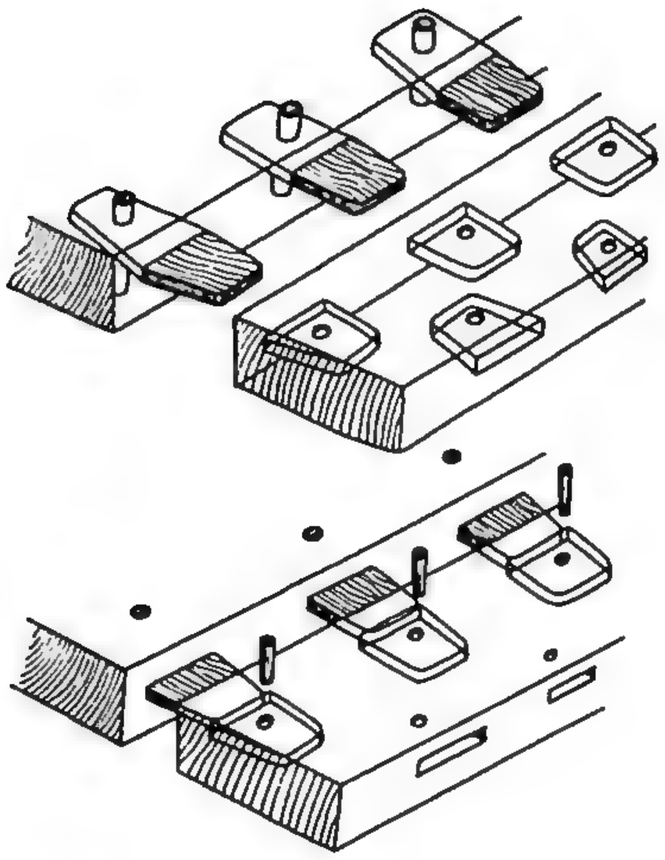


Fig. 2 Schematic sketch showing the nature of the mortise and tenon joints.
After *AS*, p. 238.

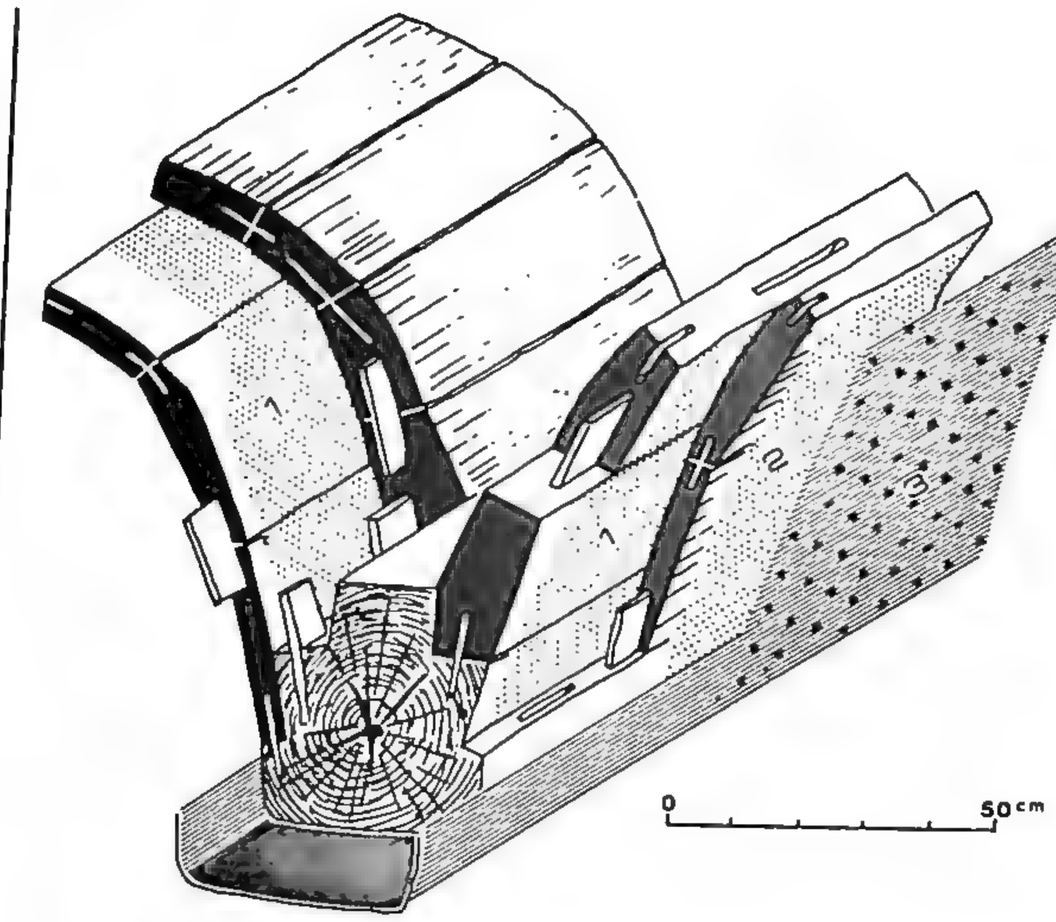


Fig. 3 The keel and garboard strakes of the Madrague de Giens wreck (mid-first century B.C.). 1 = fabric between layers of planking; 2 = fabric between exterior surface and lead sheathing; 3 = lead sheathing.
After Tchernia-Pomey-Hesnard (cf. note 12), p. 86.

cutting thousands of mortises and tenons. For another it was wasteful of material: in the parts of the hull which curved, the planks could not always be sawn but had to be carved out of the log in order to come out with the proper shape, and this consumed far more wood than sawn planking.[6] On the other hand, a hull built in this fashion was strong, staunch, and cheap to maintain, for the seams were so tight they needed no caulking.[7]

The nautical archaeologists' finds have revealed yet another contribution of Greek and Roman shipbuilding: when the shell was completed, the underwater surface was protected against marine borers by a sheath of lead sheets laid over tarred fabric and secured by multitudinous copper nails (fig. 3); this was not a universal practice but was very common, particularly in the best age of shipbuilding up through the first century A.D. By the fourth or fifth century A.D., it had been forgotten and was not revived until the eighteenth century, when the use of copper sheathing was introduced.[8]

The data for my earlier report had been drawn from fewer than a dozen wrecks. Some seven years later I was able to confirm my preliminary conclusions on the basis of almost twice that number,[9] and today the figure is considerably higher. In all instances the hull basically had been put together as described above. It was, no question about it, the method that was standard in the Greek and Roman world. It dates at least from Homer's times, the eighth century B.C., and was carried on with little change at least through the end of the first century A.D.[10] About the fourth century A.D., as new finds have revealed, there began a significant move in a different direction.

Four wrecks so far have been found in a state of preservation that was good enough to justify thorough excavation. The earliest in date, circa 310-300 B.C., was in the waters off Kyrenia on the northern coast of Cyprus; when the cargo was removed divers discovered that under it there lay almost three quarters of the hull (fig. 6), all the bottom and the lower portion of the port side. It was a small vessel, no doubt used for coastal trade, some 15 m long and 4 to 5 in beam and having a cargo capacity of 20 to 30 tons, but it is a model example of the Greek shipwright's craftsman-

6. Cf. Steffy, p. 27. There are indications that planks could be only partly finished when set into the shell and would be adzed to final shape while in place; cf. Steffy cited in *IJNA* 5 (1976), 127.
7. *SSAW*, p. 209.
8. *SSAW*, pp. 209-10.
9. *SSAW*, pp. 214-16.
10. *SSAW*, p. 203. A letter from George Bass informs me that the date can now be put back to the fourteenth century B.C., as revealed by a hull just discovered off Kaş in southern Asia Minor.

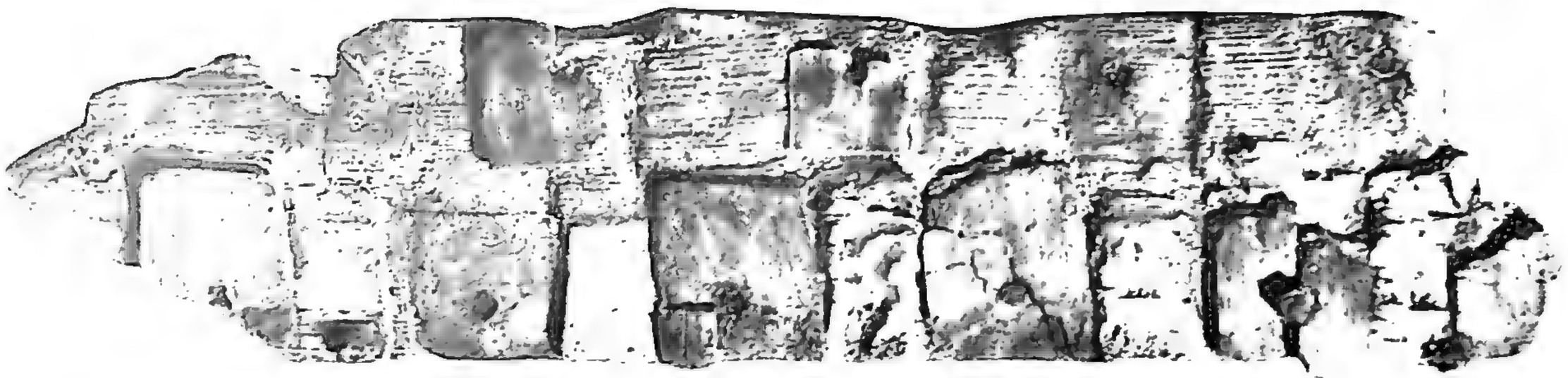


Fig. 4 Half of a piece of planking from the Grand Congloué wreck (2nd century B.C.) that had split as if filleted, revealing the mortises and tenons.

After *SSAW*, fig. 159.

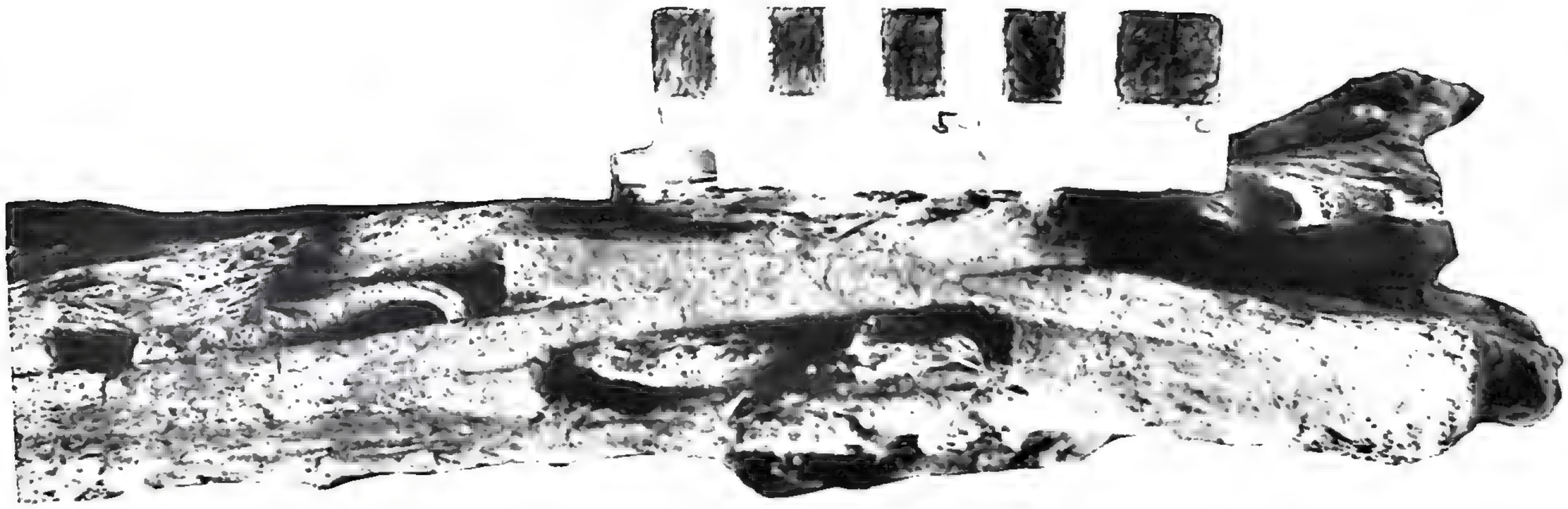


Fig. 5 The edge of a fragment of planking from the Antikythera wreck (1st century B.C.) showing the staggering of the joints.

Photo courtesy of P. Throckmorton.

ship: the mortises and tenons run 3.5 to 4.3 cm broad and are set 6 to 10 cm apart; the frames, about 10 cm wide and 8 thick, are set 15 cm apart; and the hull had a sheath of lead sheets. Carbon 14 analysis of the wood (the vessel was almost entirely of pine) and of some almonds that were part of the cargo reveals that the ship was probably eighty years old when it sank—an age that is not at all surprising in view of the sturdy way it was built.[11]

The most spectacular wreck found so far, from the point of view of both size and state of preservation, is one discovered at Madrague de Giens off Toulon. Practically the whole underwater body is preserved of a seagoing freighter of the mid-first century B.C. that was all of 40 m long, 9 m in beam, and 4.5 m deep in the hold; its capacity was at least 375 to 400 tons. It took a French archaeological team over ten years to carry out its excavation. This massive vessel was double-planked throughout, with fabric impregnated with wax or resin between the two wooden skins. Then came another layer of fabric and a sheath of lead sheets (fig. 3). Both layers of planking were edge-joined with mortise and tenon joints: in the inner these were 8 to 8.5 cm broad and 10 to 12 cm deep and were no more than 6.5 to 7.5 cm apart; in the outer they

11. *SSAW*, p. 214; M. Katzev in G. Bass, ed., *A History of Seafaring Based on Underwater Archaeology* (New York, 1972), pp. 50-52; J. R. Steffy in *Naval Engineers Journal* (October 1975), 86-90; *AS*, pp. 332-33.

Fig. 6 View of the Kyrenia wreck (fourth century B.C.) after its reassembly in the Kyrenia Museum.

Photo courtesy of M. Katzev.

were smaller, 5.5 to 5.7 broad and 6 deep, and stood somewhat farther apart, 9.5 to 10 cm. The frames were, on an average, 13 to 14 cm wide and 12 to 15 thick and most stood cheek by jowl, a mere 10 to 11 cm apart on the average (fig. 8). In the Kyrenia wreck the keel and frames were totally independent; there were no fastenings connecting the two. In the Madrague de Giens ship, every fifth floor timber, in places every seventh, was bolted to the keel—the first instance of a practice that becomes increasingly common in succeeding centuries.[12] Careful study of details has revealed the shipwright's procedure. He started in the usual manner, edge-joining plank to plank. After setting in place on either side of the keel the garboard strakes and two others, he inserted the floor timbers and, following the shape that these dictated, added planking to the turn of the bilge or thereabouts. From there he continued building the shell right up to the gunwales, at which point he inserted the rest of the framing.[13] By great good luck the prow was preserved to the very tip, and this produced a welcome discovery: We have here the remains of a type of merchantman known hitherto only from ancient representations, one with a concave prow and a pointed forefoot.[14]

A third wreck whose fine state of preservation earned it complete excavation is the Yassi Ada wreck, found off the southwestern coast of Asia Minor. It is of late

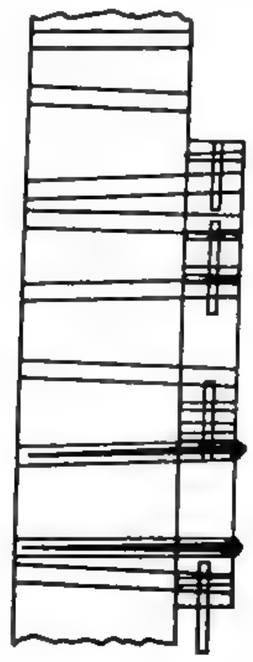


Fig. 7 Schematic drawing showing the fastening of planking to a frame by means of treenails transfixed by spikes.

After *AS*, p. 239.

date — circa 625 A.D. — and this gives it special value inasmuch as it reveals that significant changes had taken place in shipbuilding; changes that are clear forerunners of a shift to the frame-first method of assembling a hull. As a matter of fact, they were under way at least two centuries earlier, as we can tell from a wreck of the fourth century A.D. found in the same waters a dozen meters away. It had been put together in the time-honored fashion, shell-first and with the

12. A. Tchernia, P. Pomey, A. Hesnard, and others, *L'épave romaine de la Madrague de Giens* (xxxiv[e] supplément à *Gallia*, Paris, 1978), pp. 75-87; *AS*, pp. 333-34.

13. Tchernia et al., pp. 87-91. Thus the shell from the fourth strake to the turn of the bilge was, in a way, built frame-first, and this has refueled speculation (cf. pp. 92-96) about the possible coexistence in the Greco-Roman world of the shell-first and frame-first procedures. Now, in the true frame-first procedure, planking is held in place solely by being fastened to the frames. In the Madrague de Giens wreck, as the excavators are careful to point out (p. 94), the strakes in question were held in place precisely as were those everywhere else in the hull, by closely set mortise and tenon joints. The shipwright, in short, was following the standard Greco-Roman procedure save that, for reasons we cannot yet determine (cf. p. 95), he chose to insert floors at an early stage. The first example of true frame-first construction, as we shall see in a moment, is in a wreck of the seventh century A.D.

14. P. Pomey, 'Le navire romain de la Madrague de Giens,' *Comptes rendus de l'Académie des Inscriptions et Belles-Lettres* (January-March 1982), pp. 133-54. See pp. 145-46 for dimensions including prow.

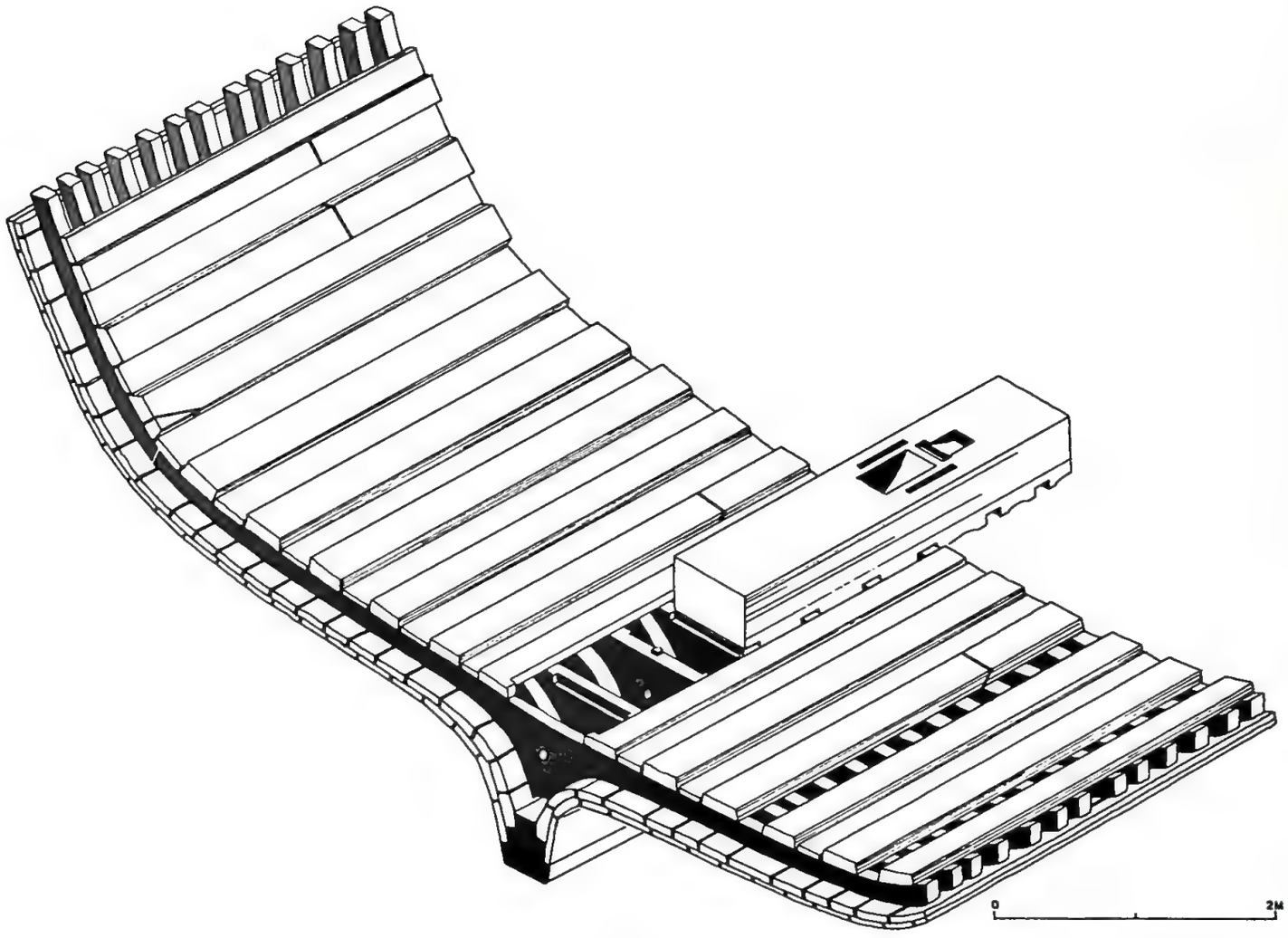
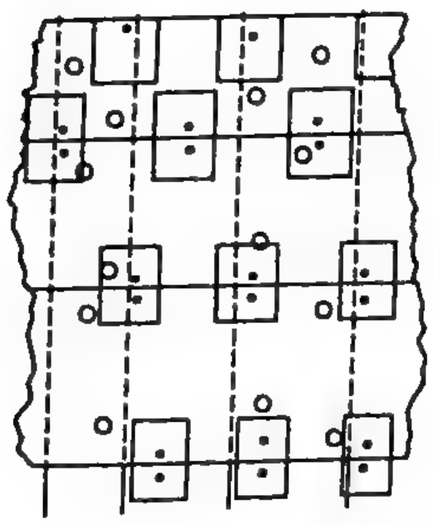


Fig. 8 Drawing of part of the hull of the Madrague de Giens wreck showing the closely set frames. Floors alternate with half-frames, as in the Kyrenia wreck (fig. 6) and others. Note the top of a bolt holding a frame to the keel. The mast step is much the same as that on the Kyrenia wreck (fig. 6) and others.

After Tchernia et al., pl. xxxix.

strakes edge-joined by means of mortises and tenons transfixed by dowels. However, the joinery was not done with the care characteristic hitherto: the tenons were fitted loosely in the mortises, and the joints were set considerably farther apart, some 17 to 24 cm. Spikes and nails of iron, rather than bronze, were used. Some of the floor timbers were bolted to the keel and stempost. The hull was not sheathed with lead sheets.[15] In the later Yassi Ada wreck all these tendencies have gone much further. The tenons fit far more loosely in the mortises and are no longer transfixed by dowels; as a result the planks are not firmly locked in place as in all previous wrecks. And the joints are spaced much farther apart than in the wreck of even just two centuries earlier: near the stem, where they are closest, the distance between is 30 to 45 cm, and elsewhere up to 90 cm (fig. 9). Most of the frames were made fast to the spine of stempost, keel, and sternpost, by bolts where strength was required, by nails elsewhere. There was no lead sheathing. What is most significant is that the hull was assembled shell-first only up to the waterline. At that point the shipwright had inserted all the frames; above the waterline

15. F. van Doorninck, Jr., 'The 4th century wreck at Yassi Ada. An interim report on the hull,' *IJNA* 5 (1976), 115-31, esp. 122-26; Steffy, p. 27.



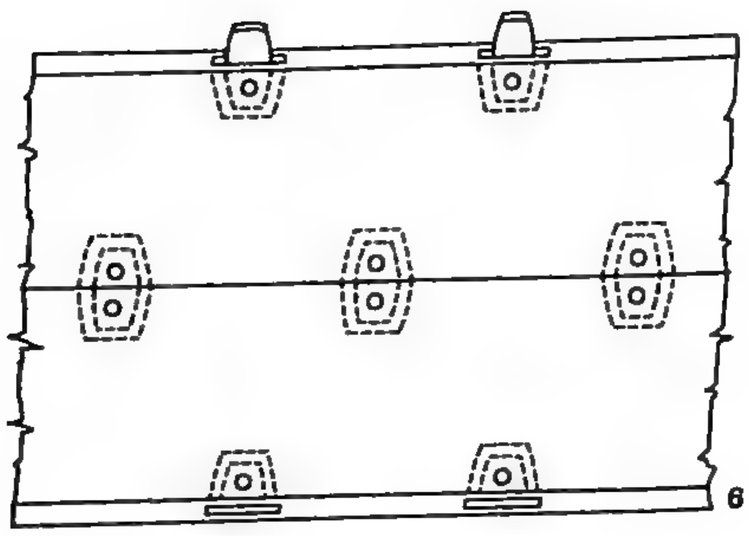


Fig. 9 Schematic drawings to show the change in the nature and spacing of mortises and tenons. Top, a typical Roman hull; middle, Yassi Ada, fourth century A.C.; bottom, Yassi Ada, seventh century A.C.
After *AS*. p. 239.

he simply bolted or nailed the planks to the framing without any mortises and tenons. In other words, from the waterline up he followed what would become the frame-first procedure.[16]

16. G. Bass and F. van Doorninck, Jr., *Yassi Ada. A Seventh-Century Byzantine Shipwreck*, I (College Station, Texas, 1982), 55-61, 84-85.

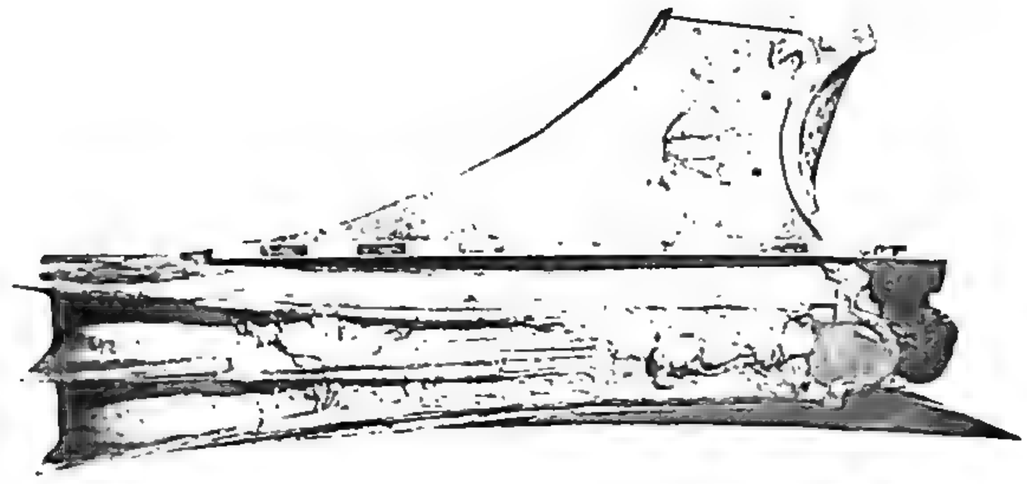


Fig. 10 The Athlit ram.
Photo courtesy of Elisha Linder.

Thus it is clear that, by the seventh century A.D., the way was paved for a shift from shell-first construction, with strakes edge-joined by means of mortises and tenons, to frame-first, with strakes made fast to the frames. This was a shift of considerable economic importance. For it vastly reduced the costs of shipbuilding by saving time, since shipwrights simply drove treenails or nails instead of cutting mortises and tenons, and saving material, since they could now use sawn planks which they bent around the pre-erected skeleton. Moreover, it permitted hull shapes that offered more space for cargo.[17]

Today we can pinpoint the date by which this crucial shift had taken place. The Serçe Liman wreck, found in the waters off southern Asia Minor opposite Rhodes, dates to around A.D. 1025. Although only one-fifth of the hull has survived, it has been studied with such care and skill that a nearly complete reconstruction is possible. And this has revealed it to be our earliest example of a vessel built totally frame-first. The keel was laid and the frames were made fast to it with heavy iron nails. The planks were then fixed on to the frames with iron nails and treenails; a standard pattern was five nails and one or two treenails to each strake per frame. It goes without saying that there was no lead sheathing.[18]

The Serçe Liman wreck was a small coastal vessel almost exactly the same size as the Kyrenia wreck, 15 m long and 5.13 m in beam. But there all resemblance ends. In the Kyrenia ship, a model example of the Greco-Roman shell-first technique, the shell was primary, the framing secondary and nowhere attached to the keel. In building it the shipwright had to waste, it

17. Cf. Steffy, p. 27.
18. Steffy, pp. 20-24.

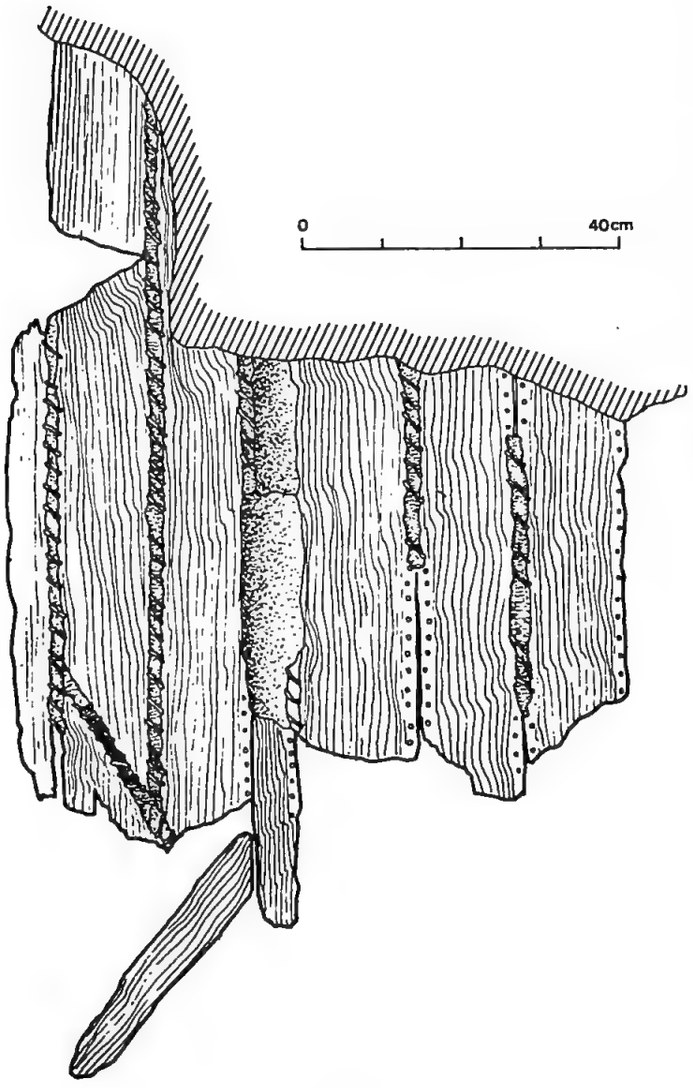


Fig. 11 The inside face of a fragment of the hull of a sewn boat that was found off Jugoslavia (first to third centuries A.C.).

After *MM* 67 (1981), 231.

has been estimated, 70 percent of each log from which he fashioned his planks, and the hull he was constrained to make was far less commodious than that of the Serçe Liman vessel. The latter was flat-bottomed with hard bilges—a shape difficult to attain with strakes bound to each other by closely set joints—and this enabled it, though the same size as the Kyrenia ship, to hold a third more cargo.[19]

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19. Steffy, pp. 26-27, 30-32.

We have dealt so far only with sailing craft. What about galleys?

The ancients, like the Genoese and Venetians in later centuries, had both merchant and war galleys. The distinguishing mark of the latter was their armored prow, their ram: the prow, powerfully built, was brought to a point at the waterline and this was shod with a bronze casing; the prime battle tactic was to drive this point into an enemy hull. Since speed was of the essence, war galleys were slender and lightly built and great care was taken to keep them from getting waterlogged: in their home ports, when not in use, they were drawn up out of the water under sheds, just as we do with racing shells; when away from home, they were beached at night.[20] Merchant galleys were not as slender, more heavily built, had no ram, and, since speed was not a consideration, could be left in the water.[21]

From 1971 to 1974 excavation was carried out on a pair of wrecks, dating around the middle of the third century B.C., found just north of Marsala in Sicily.[22] It quickly became apparent that they were the remains of galleys: the dimensions of one, for example, estimated at 35 m by 4.8, show a length to beam ratio of about 7:1; ancient sailing craft never ran more than 4:1. Both had ballast of stones in them and one had been sheathed with lead sheets—incontrovertible sign of the merchant galley, which could afford to carry such weight and could use protection against marine borers.[23] And both had been made in the same fashion as all the sailing ships we have discussed, shell-first with strakes fastened to each other by means of mortises

20. *SSAW*, pp. 85-86, 89-90.

21. *SSAW*, pp. 157-68.

22. H. Frost, 'The Punic Wreck in Sicily. 1, Second season of excavation,' *IJNA* 3 (1974), 35-42; 'Another Punic wreck in Sicily. 2, The ram from Marsala,' *IJNA* 4 (1975), 219-27, *AS*, pp. 334-35.

23. L. Basch, 'The Metal Sheathing of Roman Warships,' *MM* 65 (1979), 29-35, argues that Roman warships did have lead sheathing: since they 'operated for years on end and far from their bases . . . metal sheathing . . . could have only been to their benefit' (p. 29). It might have been to their benefit against marine borers but against enemies, in running after or from them, sadly to their detriment. Basch makes his dubious generalization by way of introducing his specific proof: two representations which, he holds, picture Roman warships with lead sheathing. One (his fig. 3) is no oared warship but a sailing merchantman; see Pomey, op. cit. (n. 14 above), p. 148 and figs. 8, 9. In the other (his fig. 4), what he takes to be lead sheathing covers the area between the waterline and the gunwale, the topsides in other words—precisely where lead sheathing should not be. If it is indeed sheathing, then this representation is to be added to those Basch identifies as products of artistic license marked by elements that are 'frankly absurd and devoid of sense' (p. 32).

and tenons.[24] The galleys, it turns out, had been built by Carthaginian craftsmen. The proof is the presence of Punic letters which they painted at given points on the hull, presumably to aid in the assembly. It follows that the method of construction we are dealing with was prevalent in areas of the Mediterranean inhabited by Carthaginians as well as by Greeks and Romans.

What of war galleys? Were they too built this way? For long the question was unanswerable, since no wrecks of war galleys had ever been found—nor did it seem likely that any would; cargo is what has been chiefly responsible for the preservation of ancient hulls, and warships carried no cargo. Then, in 1980, came a stroke of fortune: that year Israeli divers found in the waters off Athlit near Haifa the massive bronze ram of a big man of war (fig. 10). It dates probably to the third century B.C. It is a magnificent testimony to the ancient bronze caster's art, measuring 2.3 m long and 41.1 cm high at the tallest point and weighing 462 kg. By further good fortune there was still embedded in it remains of the prow over which it had been fitted—fragments of the stempost, the wales, the bottom and side planking. And the planks, examination revealed, were made fast with the characteristic mortise and tenon joints. These were 6.8 cm to 8 broad and 9 to 10.5 deep and were set 11.7 cm apart on an average.[25]

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24. L. Basch, 'When is a Ram not a Ram: The Case of the Punic Ship,' *MM* 69 (1983), 129-42, insists that these are hulls of war galleys. The principal argument put forth is that one was armed with a ram. What it actually has is a pair of light wooden arms extending forward from the cutwater, and these, according to Basch, must have held a long pencil-like ram that operated like a bee's sting: it was designed to 'hole the "soft underbelly" of the ship under attack before—predictably—breaking off at its base' (p. 137). It goes without saying that there is no parallel to such a ram in the entire history of oared warships. One of its advantages, Basch assures us, was that it would 'strike the enemy below the water line' (p. 137); but he himself points out that any number of conventional rams would do the same (p. 136). Another was that it would 'leave undamaged the hull of the attacking ship.' So did the conventional ram, to judge from the ancient descriptions of naval battles, save for rare exceptional circumstances. And an expert on naval construction, on the basis of study of the remains of an ancient ram, concludes, 'I doubt the attacking vessel suffered any damage from a normal ramming manoeuvre' (J. R. Steffy in *MM* 69 [1983], 241). After listing the two putative advantages, Basch adds, as if it were a minor consideration, 'There was a price to be paid for these advantages: such a ram . . . could only be expected to serve once in the course of a campaign.' What a price! To expend money and manpower on a class of ships which, after striking one blow, had to turn tail and race for home to avoid being easy targets for enemies with conventional rams! How many naval craft of this ilk would an ancient navy have to maintain? How many would a modern navy of a class of ships designed to go into action with a single round of ammunition?

25. J. R. Steffy, 'The Athlit Ram: A Preliminary Investigation of its Structure,' *MM* 69 (1983), 229-47, esp. 238, 240, 244.

So far we have dealt only with evidence from the Mediterranean. But remains of wrecks have turned up in northwestern and central Europe as well—near London in England, Bruges in Belgium, Rotterdam in Holland, at Yverdon in Switzerland—and these throw light on what was happening outside of where Greco-Roman shipwrights were at work. Some of the finds were made long ago but most within the last two decades, and all have only recently been properly interpreted. They reveal a feature of prime importance: the shipwrights there, in most cases probably Celts, were using a form of frame-first construction at least as early as the first century A.D. The majority of the hulls that have been discovered are of barges or river boats, but there is at least one, and perhaps two, of vessels that were seagoing freighters. Did the Celts invent this form of shipbuilding that was to be the form *par excellence* in Europe from the Middle Ages on? Did Celtic shipbuilders exercise an influence on developments in the Mediterranean? The evidence is yet too scanty and too scattered to provide sure answers.[26]

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At the outset of this article I mentioned that one common way of fastening strakes to each other was by sewing. We were long aware from casual mention in ancient writings that this method had been in use in the Mediterranean ever since the days of Homer and very likely earlier. The findings of the past decade have supplied concrete proof: some four wrecks that range in date from the sixth century B.C. to medieval times. In most instances the planks were held together by dowels as well as ligatures, but there is at least one in which they were simply ligatured (fig. 11). The technique was to bore holes, one near the edge of the plank on top and the other in the matching spot of the plank below, and then gouge a channel on the exterior surface from the hole to the edge so that the cord, when passed through, would not protrude. Then, after the sewing had been completed, the holes were plugged with pegs to render them watertight.[27]

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The past twenty years, in sum, have added much to our knowledge of ancient shipbuilding. It is now cer-

26. *SSAW*, pp. 338-39; P. Marsden, 'A boat of the Roman period found at Bruges, Belgium, in 1899, and related types,' *IJNA* 5 (1976), 23-55, esp. 42-54.

27. P. Pomey, 'L'épave de Bon-Porté et les bateaux cousus de Méditerranée,' *MM* 67 (1981), 225-44.

tain that the standard way of constructing a hull among the Greeks and Romans and at least some of their neighbors who shared the Mediterranean shores with them was to build up a shell of planks, joining these edge-to-edge by means of closely set mortises and tenons. It is now certain that this method was used for the hulls of galleys, both merchant galleys and men of war, as well as of sailing ships. We can now confidently state that the transition from this method to that which ultimately prevailed in Europe, the setting up of a skeleton of keel and frames and the fastening to it of a skin of planks, was well under way by the seventh century A.D. and had been completed by the eleventh. And we are aware that in northwestern Europe present evidence indicates a version of this method had been in use long before it appears in the Mediterranean.

Lionel Casson, professor of classics at New York University, has published numerous books and articles on the maritime history of the ancient world. His most recent book appeared just this year: Ancient Trade and Society *(Detroit, 1984). He is at present working on a study of the trade connections by water between the Roman Empire and the far east.*

The Wreck of *San Francisco*

By Richard E. Crighton

AN editorial in the *New York Daily Times* of 17 January 1854 estimated that a total of 130 principal vessels were sunk during the year 1853 with a loss of 1,924 lives. Shipwreck, in those days, was a sufficiently commonplace occurrence to rate little public interest and rarely more than routine news coverage.

In contrast to this attitude of popular indifference was the sudden surge of attention which focussed on a single maritime disaster—the wreck of the steamship *San Francisco* on Christmas Eve, 1853. Here was a story that held universal appeal—intrigue, scandal, disease, death, cowardice, bold heroics, and bumbling incompetence.

San Francisco was built by William H. Webb, the famous New York shipbuilder, for W. H. Aspinwall & Co., owners of the Pacific Mail Steamship Company and she was launched on 9 June 1853. Her wooden hull had been specially strengthened by the inclusion of fore and aft bulkheads reinforced with double iron diagonal braces. She was a handsome ship with a clipper bow, two smokestacks, auxiliary sails and two side paddle wheels of 25-foot diameter, each propelled by an oscillating steam engine of 1,000 horsepower. She was 281 feet in length, 41 feet in beam, and her hold was 25 feet deep. She had elegant stateroom accommodations for 350 persons, steerage berths for 1,000, and was intended by her owners to ply between the Isthmus of Panama and San Francisco.[1]

After her launching, *San Francisco* set out on her first steaming trial in the calm waters of the Hudson River. Within an hour, the air exhaust pump failed, she lost steam and had to be towed back to her berth. After thorough inspection, the failure was attributed to a newly patented condenser and the engineers went to work with modifications to try to eliminate the fault. Despite their efforts, the same failure occurred on the second and third steaming trials and each time the proud ship had to be returned ignominiously to her berth by attending tugboats.[2]

The owners' urgency to solve this aggravating engineering problem was accelerated by an unexpected commercial opportunity. In October 1853 the United States Army quartermaster-general in New York, Col. Thomas R. Swords, placed an advertisement calling for proposals

> . . . for the transportation hence to San Francisco via Cape Horn, of about 30 officers and 475 men and laundresses, by steamer, clipper or full vessel.
>
> The men to be provided with berths, water and means of cooking with ample room in the hold for their stores and luggage and about 1500 barrels of extra provisions. The officers to be furnished with cabin fare and accommodations.
>
> The vessel or vessels to sail on or about the 20th instant. (Vol. III, no. 746, 7 February 1854, p. 8, col. 1.)

A golden opportunity had suddenly presented itself for the owners of the Pacific Mail Steamship Company to get their ship to its station and, at the same time, earn a profitable charter. They immediately entered a bid of $75,000, although their engine problem was still unsolved and they knew full well that their ship could not possibly comply with the 20 October sailing date.

The regiment which was to be transported was the 3rd Regiment of United States Artillery, commanded by Colonel Gates. Upon receipt of all the bids, Colonel Gates accompanied Colonel Swords on an inspection tour of all the vessels which appeared suitable and they narrowed their selection down to two—the clipper ship *Lightfoot* and *San Francisco*. They referred the final choice to General Wool, who had been appointed to superintend the troop embarkation, and he, in turn, passed the problem on to his superior, General Scott, in true bureaucratic tradition. After a lot of ponderous official correspondence which extended long past the original sailing date, *San Francisco*'s bid was accepted.

1. Edouard A. Stackpole, 'The Wreck of the Steamer "San Francisco,"' *The Marine Historical Association, Inc.*, No. 27 (December 1954), p. 3. Hereinafter, all references from this source will be referred to as Stackpole.

2. 'Justice,' *New York Daily Times*, 19 January 1854. All further quotations from this source appear in parentheses in the text.

At this point, the deskbound general staff of the army began a process of well-meant but bungling interference in the ship's overall sailing instructions which set the stage for her final undoing. Among the official orders which sealed the fate of *San Francisco* were the following:

1. The steamer must not go to Panama or to any other port which would subject the troops to the ravages of contagious disease, the ports mentioned by Mr. Aspinwall for taking on coal alone excepted.
2. . . . Officers and men should not be restricted to the ordinary amount of luggage, furniture and stores.
3. . . . send such number of wagons as can be conveniently stowed in the steamer.
4. The annual supply of medicines for the troops on the Pacific will be sent in the steamer, with the subsistence stores designated by General Scott, i.e. not less than *nine months* supply for the command [emphasis mine]. (Vol. III, no. 746, 7 February 1854, p. 8, col. 2.)

Two critical effects resulted from these orders:

The first port of call was to be Rio de Janeiro, a distance of 5,000 miles from New York. This necessitated the loading of a huge supply of coal, and since the price of coal was twenty-four dollars[3] cheaper in New York than in South America, the owners took full advantage of the situation by loading 800 tons. Compounded with the enormous weight of furniture, stores, and personnel, this caused *San Francisco'*s draft to sink to 16 feet instead of her design draft of 12 feet, thus perilously repressing her speed and navigability.

The coal was piled throughout the length of the ship in the lower steerage quarters, with the excess stacked in bags on the upper deck. This, in turn, meant that there was insufficient below-deck accommodation for the troops, so six companies—approximately 300 men—had to be bivouacked on the exposed upper deck in portable canvas berths. Considering that there had been a snowfall in New York on the night before the ship sailed, the prospect for these men was a dismally cold one. However, in mitigation of their callous decision, the armchair planners argued that, once the ship reached the temperate climate of the Gulf Stream, the men would be better off in the fresh air than stifling in the hold.

By the time the planners had completed their task, *San Francisco'*s engine problem had been solved by a simple expedient—the offending condenser had been entirely removed. Although it occurred to at least one of the ship's engineers that the stripping of the condenser would create a chain reaction of additional stress on the remaining components of the air pump, his voice was conveniently smothered at the time. However, following his rescue, this officer wrote to the *New York Daily Times* on 19 January 1854, under the sobriquet 'Justice,' as follows:

> . . . It may not be known to the public generally, but it is known to the officers who formed part of the command on this ship, that her engine had never worked well—even here in smooth water. She had been furnished with a patent condenser. That condenser was a total failure. It was tried thrice and failed each time. The part that constituted the patent was *removed and the same cylinder retained.* The air pump which was made to exhaust the air contained in a series of pipes placed within the cylinder of the condenser was thus, after removal of these pipes, required to exhaust all the air in the entire cylinder. The pump had not sufficient strength or capacity to perform this increased duty. . . . Let the city and the Country demand an investigation. . . .

On Tuesday morning, 21 December 1853, Colonel Gates was at Judson's Hotel in New York attending to final arrangements for his family to board *San Francisco* that afternoon. He had just finished breakfast when he was visited by his adjutant, Lieutenant Fremont, who delivered a letter to him. The letter, addressed to Lieutenant Fremont by the regimental surgeon, Doctor Saterlee, stated that he

> had learnt, unofficially, that the measles were prevailing amongst the children of some of the officers about to embark, and that if such were the fact, those children should not go on board, nor any children who were disposed to take it, and that he deemed the measles on shipboard among men is as bad, if not worse, than the smallpox. (Vol. III, no. 749, 10 February 1854, p. 8, col. 1.)

One can only guess Colonel Gates's true feelings as he read the letter, since he was well aware of the source of Dr. Saterlee's concern: the youngest of the colonel's three sons was, at that very moment, prostrate with the measles in an upstairs bedroom!

Whatever his private thoughts, Colonel Gates was not one to submit to any impertinent sermonizing from his subordinates. He folded the letter and returned it to Lieutenant Fremont with a perfunctory remark that it was much ado about nothing and that the measles was a trifling matter.

3. Stackpole, p. 4.

Throughout the day, 21 December, the embarkation of *San Francisco* proceeded. Most of the cabin passengers boarded in the morning before the troops arrived, and comprised two groups: regimental officers with their wives, children, and relatives, and 'captain's friends.'

'Captain's friends' consisted of a few privileged civilians who had applied to take passage and who had been individually approved by the general-in-chief or, failing this, Colonel Gates. Among them were the Brazilian consul, his wife and aides, a United States naval officer, a dragoon officer, an Episcopalian minister and his family, the shipowner's brother, Mr. Aspinwall, and James Lorrimer Graham, Jr., a young man of good family employed as a clerk in the Aspinwall company.

Most of the regimental officers' party was comfortably billeted aft and below decks in a group of staterooms surrounding the main saloon. Captain's friends and a few other officers were quartered in choice cabins around the upper saloon, which was a superstructure opening directly on the upper deck.

The troops arrived at the ship in the afternoon, marching in miserably cold weather behind their regimental band. About 200 of the more fortunate ones were ordered to the forward hold, which was crowded with rows of three-tier wooden bunks; the remaining 300, many of them bewildered raw recruits, were mustered on the open upper deck and put to work stowing baggage and erecting temporary canvas sleeping berths for themselves.

In the wake of the troops came a large contingent of camp women, including wives, servants, laundresses, and their children. Noncommissioned officers' families were directed to a cabin of 36 berths forward of the upper saloon. Others were housed in a 120-berth cabin next to the troops in the hold, where they were joined by the regimental band.

All told, including the ship's company, about 750 souls settled down to their first night's sleep aboard, some considerably more comfortable than others. Little did they know that, in a few days, the accommodations to which they had been arbitrarily assigned would determine whether they would live or die. Only one officer took a hand in his own undoing. Major Taylor and his wife had taken one look at their allotted cabin below decks and declared it unsatisfactory. In an excess of *lèse majesté*, the major had insisted on an exchange of accommodation with a junior officer, Lieutenant Loeser, who was billeted in the upper saloon. The Taylors' fate was sealed.

Thursday, 22 December, dawned clear and cold. *San Francisco*, which had moved to a berth in the stream after taking on the troops, weighed anchor at 8:30 A.M. and began her majestic journey down the bay and out to the open sea. As she passed Fort Hamilton, she was greeted by the 4th Artillery band and a formal gun salute, to which the troops replied with a hearty round of three cheers.

All went well for thirty-six hours. Then, as the ship reached the edge of the Gulf Stream, storm clouds began to gather about her.

San Francisco's inexorable progress toward her place of doom is succinctly recounted in a 'digested and authentic statement of one of the officers of the ill-fated ship,' as reported in the *Times* of 14 January 1854:

> Dec. 23 - Continues with light breezes and pleasant weather. At 12:20 P.M. discharged pilot outside the Bar. Latter part of night, the wind increased and hauled to the Westward. Set the fore and aft sails and, at noon, the square sails. Fag ends with fresh breeze from the West and cloudy weather.
>
> Dec. 24 - Moderate breeze from West, and cloudy weather. Bent studding sails. Heavy rain toward evening. At 6 P.M., the wind died away to a light baffling breeze: weather very threatening. Took in all sail. Ship going 8½ knots. Temperature of weather 67°, water 54°. At 9 P.M. wind came suddenly from N.W., blowing very strong, and the sea making up rapidly. . . .

Within an hour of entering the storm, *San Francisco*, lumbering under the huge weight of her cargo, became unmanageable. The force of the wind, blowing directly up her stern, made her practically impossible to steer and by 10 P.M., her head had swung to northward and she was broached to, wallowing in a beam sea.

The only hope of righting her was to increase speed so that she would answer her helm more readily. Captain Watkins, the master, immediately called for full speed from the engine room and ordered the foresail to be set. These measures had some temporary effect, but as the night drew on, the more Captain Watkins strove to thwart the storm's rage, the more furiously it lashed at its helpless victim. By midnight, as though impelled by some malicious purpose of its own, the storm had reached hurricane proportions, torn the sails to shreds, and forced the ship back into the trough of the sea.

The guards protecting the paddle wheels were smashed, tearing great holes in the deck planking, and the sea was pouring over the bulwarks, sweeping baggage, barrels, coal bags, hen coops, hay boxes, and anything movable before it.

Doctor Wirtz, a survivor, recounts his impressions from the relative security of the main cabin.

> The noise of the storm, heard in the cabins below, was deafening—the creaking and groaning of spars and timbers: the terrible harping of the wind among the cordage and around the smokestacks . . . ; the hurried tread of the crew and the hoarse command of the officers—all these combined with the incessant blows of the angry sea upon our quarter, and the wash of the spray over the skylights and hatches to form a din that suppressed every other sound. Yet to those who were gazing out on the storm, there seemed to be, in the midst of this uproar, a strange kind of silence, which was more *apalling* than the elemental confusion itself. For instance, when the gale was at its worst and the noise of the tempest most powerful, those who were standing together . . . could hear each other's lightest whisper. This was peculiarly remarkable, as the ship poised for a second, just as she was about to make one of her dreadful plunges. At such moments a perfect hush would settle over us, as the huge bows rose up darkly against a billow, and then, as it sank . . . , an instant afterwards, hundreds of feet below us in the black cavity of the sea, apparently yawning to engulf us beyond redemption. . . . (Vol. III, no. 727, 16 January 1854, p. 9, col. 3.)

If there was awed hush among the cabin passengers, there was the silence of petrified terror among the soldiers on deck. Shivering and soaked to the skin, they clung desperately to anything which provided a handhold.

At approximately 3:30 A.M. on Christmas Day, the treacherous air exhaust pump broke down and the engines came to an abrupt halt. The ship now lay dead in the water, tossing helplessly at the complete mercy of the elements.

An hour and a half later, *San Francisco* gave a sickening lurch as she slid headlong down the underside of a towering wave. There followed a crack like a musket shot and her foremast snapped six feet from its base, carved a slow arc against the sky, and crashed on the forecastle with the sound of an exploding powder magazine. With it went a tangle of spars, canvas and rigging, and four smashed lifeboats.

Among those who rushed on deck to see what had happened was Colonel Burke, who had been sleeping in one of the upper deck staterooms. Reacting at once to the sight of the half-drowned troops on the open deck, he ordered as many as could be contained to take shelter in the upper saloon. About 150 exhausted men managed to squeeze in, standing shoulder to shoulder in the small room.

Christmas Day dawned cloudless, as though the howling wind had stripped everything out of the sky and left it starkly empty. With the cloak of darkness lifted, some of the surrounding menace seemed to have been dissolved. There was almost an element of grandeur in the awful power of the monstrous, boiling sea. It was a moment of respite, but it was brief.

At approximately 7 A.M. a colossal mountain of water fell on *San Francisco*.

Let the eyewitnesses tell the tale. From 'a lady passenger's' account:

> . . . a deafening crash, not so much like the falling of houses as crushing them in from the roof downwards, as you might crush a pile of pill-boxes, sent the blood away from my heart, and left me so utterly petrified that I had no power even to sink upon the ground. Then I felt our fate was decided. I heard the commencement of screams that were stifled by choking waves, and at the same moment the water came rushing into the cabin, as if the vessel's side had been cleaved and she had already begun to sink. Then, my friend, there was indeed horror on board that ship. The confusion, the wailing, the praying, the groans of agony from the maimed and bruised, the shrieks from the ladies in their berths. . . . (Vol. III, no. 729, 18 January 1854, p. 2, col. 1.)

And from Doctor Wirtz, who had crawled to a hatch opening on to the upper deck:

> . . . I beheld the open sea where a moment before there had been a cabin crowded with human beings. A glance told me all; the water hissing about the scattered panelling; the hurricane deck down upon the lower one and swept half way over the side: two or three crushed bodies near me covered with blood which stained the broken planks, and even dripped to the steps through the seams of the lower cabin, . . . to leeward the bleeding heads of my roommates dipping and rising through the foam, as they struggled in their last agony. . . . (Vol. III, no. 729, 16 January 1854, p. 2, col. 1.)

This single massive wave had virtually stripped the upper deck of *San Francisco* clean. It swept the entire saloon superstructure overboard, including the 150 men whom Colonel Burke had ordered to shelter,

Major and Mrs. Taylor who had insisted on switching cabins with Lieutenant Loeser, three other officers, four crew members, and three civilians, one of whom was Colonel Gates's eldest son. It snapped off both smokestacks, stove in the remaining lifeboats, gashed open the quarterdeck and stripped the starboard paddle wheel. The upper deck was a shambles and water poured into the ship in a dozen places. Yet, there were some narrow, even miraculous escapes. Captain Gardiner of the First Dragoons had been asleep in his stateroom moments before the wave hit. His servant came to wake him and warn him that the ship was in great danger. He

> . . . had hardly uttered the words when the wave, which had hurried so many into eternity, swept the servant overboard, while Captain Gardiner, by a special Providence, was the only man on that deck who was saved. (Vol. III, no. 727, 16 January 1854, p. 1, col. 3.)

Despite this account, there *was* another survivor. Mr. Frederick H. Southworth gives his own version of what happened.

> I was lying in my stateroom . . . when there came a shock and sudden crash of breaking timber, and I felt myself rolling like a top in the water, with salt brine rushing into my mouth and almost blinding me. When I arose to the surface . . . a harrowing sight was before me . . . I saw about forty men struggling for life, and about one half of them had blood streaming from wounds about their heads. . . . I was a half mile from the steamer and around me was about an acre of floating timber. Two or three swells tossed me near the ship and I grasped a rope forward of the wheelhouse . . . a friendly wave threw me against the guard of the vessel which I seized hold of. . . . I was enabled at last to crawl upon the forward deck and there broke open a stateroom window, and crept into it, half-drowned.[4]

As the water poured into the ship, those below felt themselves trapped, and blind panic drove them up the crowded gangways to the upper deck. In a letter to the *Times*, published on 16 January 1854, Mr. James Lorrimer Graham, Jr., describes the scene:

> The horror of the moment cannot be described . . . fathers, mothers, brothers and sisters—from the grey-haired veterans of the Army to the child that nestled at the mother's breast—all were seen groping their way through the water to the upper deck. Several, in the excitement of the moment, sprang overboard. . . . We remained many hours upon the deck, the sea washing over us at every lurch of the vessel and the cold northwest wind chilling us to the heart. I never experienced such intense cold. . . .

Captain Watkins, a veteran of the China trade, rose to the occasion undaunted. With the help of Lieutenant Murray and some of the younger artillery officers, he immediately organized the soldiers and spare crew into bailing gangs, while others were put to the task of lightening ship by throwing everything movable overboard. Mr. Aspinwall, although suffering from consumption, was one of the first to volunteer for bailing duty.

When one considers the utter chaos and despair which now prevailed, it is almost incredible that order could ever be restored. Yet, thanks to Captain Watkins's stubborn tenacity and splendid leadership, a relative calm had descended on the ship by afternoon; considering that the buffeting of the ship had not eased, that most of the passengers were in soaking nightclothes and that the cabin spaces were awash with sloshing water, this was an extraordinary achievement. Captain Watkins's example inspired a number of other heroes. Mr. Graham, the young clerk, paid tribute to some:

> So much has already been said with reference to the noble conduct of Captain Watkins and Mr. Mellus *(first mate)* that it would seem idle to add further tribute to their bravery . . . the Purser, Theodore L. Schell, and the storekeeper, Mr. Wickham deserve special commendation. They were at the most prominent points of danger, doing their duty like men. . . . The chief engineer, Mr. John Marshall deserves the highest credit . . . when his assistant engineers had given out, he proved a host to himself and performed the duties of a dozen men. . . . I cannot help here repeat the name of Lieut. Murray of the United States Navy who deserves the highest credit that words can bestow for his activity, courage and intrepidity. Several of the officers of the artillery displayed great courage and energy in their efforts to have the steamer pumped. Of these I feel myself duty bound to allude particularly to Lieut. Charles S. Winder, Lieut. James Van Vost and Lieut. Chandler. (Vol. III, no. 727, 16 January 1854, p. 1, cols. 3, 4.)

A hero of another kind, who is mentioned many times in the ladies' accounts of their ordeal, was the Reverend Cooper whose faith and spiritual guidance was always at hand to console them.

4. *Ibid.*, p. 5.

Rev. Mr. Cooper was also active in consolation. He prayed with us and in many ways aided the officers of the ship in sustaining hope in the hearts of the more timid and desponding. (Vol. III, no. 729, 18 January 1854, p. 2, col. 2.)

One officer is conspicuous by his absence from the many accounts of personal bravery: Colonel Gates, the commanding officer of the regiment.

About midday, hope suddenly soared aboard *San Francisco:* a brig had been sighted which eventually maneuvered within hailing distance of *San Francisco;* she was *Napoleon* of Portland under the command of Captain Strout.

Captain Watkins asked Captain Strout to send a boat. Captain Strout replied that he could not send a boat due to the huge seas but that he would try to stand by. He told Captain Watkins to set up a light. The two ships then drifted apart and by morning, *Napoleon* had disappeared. There was considerable controversy about *Napoleon*'s 'desertion' in the Portland, Boston, and New York papers, culminating in an indignant letter from Captain Strout to the *New York Daily Times* published 18 January 1854 in which he states:

I would much rather have been on board the steamer than the brig . . . I have been most unjustly slandered by the Boston papers . . . with my two best sails gone, tossed about at the mercy of the wind and waves. I did the best I could. . . . My conscience acquits me . . . I only hope the same may be true of those who have invented and propagated such shameful falsehoods.

Napoleon made Boston on 7 January 1854 and Captain Strout immediately made a telegraphic report of *San Francisco*'s condition. (Vol. III, no. 721, 9 January 1854, p. 1, col. 2.)

Since *San Francisco*'s upper deck was uninhabitable, all who remained alive were crowded into the deck below. Some 400 to 500 soldiers, women, and children were crammed into quarters 'never designed for more than 200.' (Vol. III, no. 729, 18 January 1854, p. 5, col. 1.)

Many of the men were raw recruits and they were hard to manage. Lieutenant Fremont commented: 'I found they had much less respect for orders than I had ever seen exhibited before in any command. I found that they shirked work at the engine room . . . they were very slow to obey.' (Vol. III, no. 748, 9 February 1854, p. 8, col. 1.)

Miss Eaton, a cabin passenger who had been transferred for safety to the men's hold, said of them:

The language of the men and their recklessness was truly horrible . . . it was difficult to control them . . . some would get off (bailing) if possible, hiding under mattresses and any other place they could not be found . . . they got at the liquor but fortunately Capt. Judd came in time to prevent their breaking open the casks . . . they even got at the bay rum and were drinking it when my brother [Lieutenant Loeser] took it away.[5]

The troops were not the only ones to 'indulge their appetites without restraint.' Some of the waiters broke into the storeroom and

partook of preserves, cakes, sweetmeats, dainties of all kinds ad libidum, and then repaired to the spirit room, where they washed down their repasts with copious and undiluted draughts. The effects of this conduct unexpectedly manifested themselves in violent attacks of cramp and diarrhoea. Some of the debauchees died in less than ten hours. . . . (Vol. III, no. 726, 14 January 1854, p. 1, col. 3.)

The fact that dead bodies were being pitched over the side required some explanation and, to avoid panic, it was convenient to attribute these deaths to irresponsible overindulgence. But Doctor Buel, the ship's surgeon, knew better. In a letter to the editor of the *New York Daily Times,* dated 18 January 1854, Doctor Buel tore away the veil of secrecy which had been wrapped around these deaths. 'The sickness,' he said, ' . . . was malignant cholera.'

The cholera actually started among the women and children. 'Their food had been hard bread and water, and nothing else.' Describing the cabin, he continues:

We have here in operation excessive overcrowding and accumulated filth without ventilation; bad air, meagre and insufficient diet. Add to these the strong influences of moral causes, all the depressing passions—fear, anxiety, agony of mind. Shall we look any further? Not one in ten of these victims touched or tasted preserved meats or fruits. . . .

In those days the very mention of cholera was enough to drive people mad with terror. There was no cure, no antidote, and no understanding of the causes. Public response to an outbreak was often hysterical:

5. Ibid., p. 18.

People taken ill on the numerous boats that plied up and down the Firth of Forth . . . were often dumped ashore and left untended. . . . Three female beggars who developed signs of cholera . . . were turned out by the lodging-house keeper . . . and lay uncared for by the roadside for several hours. Ultimately . . . they were lodged in the town jail where they died one by one. . . . A young woman suffering from cholera dragged herself five miles . . . to take refuge with her mother. As soon as the villagers learned that he (the doctor) had diagnosed cholera, the woman was dragged from her bed and sent back in a cart . . . she died the same night. The mother was forced out of her home and . . . the terrified villagers burned her cottage to the ground, with everything it contained.[6]

A Doctor Howison described how, during an Irish epidemic, 16,000 of the 18,000 inhabitants of Sligo 'fled the place in terror, the wealthiest families paying 40 to 50 pounds for a small room in the country . . . the poorer classes living . . . under canvas . . . in the woods and under hedges.'[7]

It was in 1854, the year after the wreck of *San Francisco* that cholera marched with the British army to the Crimea and decimated its ranks, and it was Florence Nightingale who first demonstrated the clear connection between dirty sanitary conditions and the cholera mortality rate.

The following year, 1855, Doctor Snow published his second edition of 'On the Mode of Communicating Cholera' in which he advanced the theory that it was spread in drinking water.

It was not until 1884, thirty years *after* the wreck of *San Francisco,* that a German scientist, Dr. Robert Koch, actually identified the cholera bacillus.

Doctor Buel, aboard *San Francisco,* proved shrewd in laying the blame for the disease on the filthy conditions of the cabin, but he could do nothing about it. To open a porthole would have been to sink the ship. The helpless victims, racked with violent diarrhoea and vomiting, were unable

to leave their berths to attend to the ordinary wants of nature. The result can better be imagined than described . . . fumigation of coffee, sugar, vinegar, etc, upon hot coals, were resorted to. But then, though they may relieve unpleasant odors, cannot convert a foul atmosphere into a healthy one. (Vol. III, no. 729, 18 January 1854, p. 5, col. 1.)

6. Norman Longmate, *King Cholera* (London: Hamish Hamilton, 1966), p. 54.
7. Ibid., p. 138.

Doctor Buel had but one course open to him: to conceal the true cause of death, lest the beleaguered *San Francisco* become a floating madhouse.

If some of the desperate men aboard saw the catastrophe as an opportunity to steal food and liquor, others looked to more profitable loot. The *New York Daily Times* of 13 February 1854 ran a brief story about 'the important arrests of several villains by Captain Brennan for plundering the living and the dead of the ill-fated craft . . . among the plunder recovered on this occasion was the wedding watch belonging to the lady of Lieutenant S. L. Fremont, necklaces, diamond pins, and bracelets.'

On the night of 26 December, the hopes of the passengers were to be raised and dashed once more. A brig, *Maria Freeman* of Liverpool, came within hailing distance and agreed to stand by. By dawn of the next day, she had disappeared.

Twenty-seven December was an uneventful day, with no sail in sight and the sea still running high. The men were engaged in bailing, pumping, and clearing the wreck. The remains of the upper saloon were cut away and the helm was shifted aft from the staved-in wheelhouse.

Meanwhile, the engineers who had been working without respite for fifty hours on the air exhaust pump sent word to the captain that they were ready to make steam. Captain Watkins was delighted. A helmsman was lashed to the wheel and, with the engines running slow ahead, the ship's head was turned slowly into the sea. But, before anything else could be accomplished, the pump broke again and the poor helmsman was carried below with a broken leg. Even the indomitable Captain Watkins must have shared in the general despondency that ensued. Then, just before dark, another faint ray of hope appeared: a bark was sighted hove-to to windward. Would it still be there in the morning?

At dawn on 28 December, the good news spread quickly through the ship. The bark, *Kilby* of Boston, thirty days out of New Orleans, was still in sight and approaching. By midday she was within hailing distance and, at Captain Watkins's request, she sent a boat alongside.

Captain Watkins and Lieutenant Fremont, the adjutant, immediately prepared to go aboard *Kilby* to make arrangements for rescue. However, because of the huge seas that were still running, the small boat proved unsafe for two passengers, so Captain Watkins went

alone, with authority from Colonel Gates to charter *Kilby* on behalf of the United States Army.

The master of *Kilby,* Captain Low, was a young man on his first voyage in command.[8] When asked what he would charge to charter his ship, he deferred to Captain Watkins's advice: all he wanted to do was to protect his owners. (Vol. III, no. 732, 21 January 1854, p. 8, col. 3.) A charter agreement was drawn up and signed in pencil. (In tribute to Captain Low, it should be added that the pencilled agreement was later superseded by a more formal one drawn up in ink by Colonel Gates. The ink version included a $1,000 personal reward to Captain Low. On 18 January 1854 Captain Low wrote to Lieutenant Fremont pointing out the discrepancy and asking for it to be withdrawn. 'I did not work for gain,' he said.)

Kilby was barely seaworthy herself. She was desperately short of provisions and had only two sails left, which were old and only serviceable in reasonably fair weather.

By the afternoon of 29 December, the storm had abated a little. Captain Low brought *Kilby* close up and a hawser was attached between the two ships. Transfer of passengers began.

The first two trips carried Lieutenant Van Vost and twenty men with orders to help Captain Low unload and jettison his cargo of cotton bales in order to make room for the passengers. At the last moment, Captain Judd was added to this detail.

Orders were then given by Colonel Gates to transfer the women and children in order of ranks of the women's husbands, to be followed by any disabled officers. According to Mr. James Lorrimer Graham's eyewitness account, Colonel Gates then

> addressed the troops, declaring he would be the last to desert the ship and that he hoped the officers and soldiers on board would follow his example and wait with patience. . . . I was on deck at the time and shall never forget the scene of confusion which ensued. The first boat that left carried Colonel Gates and his family. (Vol. III, no. 727, 16 January 1854, p. 1, col. 3.)

By dusk, about one hundred people had been transferred to *Kilby*. Among them were most of the cabin passengers including Captain Gardiner, who had been injured, Doctor Saterlee, who was sick, and Lieutenant Murray, who had taken charge of one of the boats. For some inexplicable reason Doctor Wirtz, the assistant surgeon, was also among those to abandon *San Francisco*.

Just after dark, the first mate of *Kilby* announced to Lieutenant Fremont that the rescue operations would be discontinued until the next morning. Lieutenant Fremont tried in vain to reason with him and offered to pay up to $100 a man if they would work all night. When they refused, he decided to embark with them and to try to get Captain Low to reason with them. Before leaving, he ordered Lieutenant Loeser, the commissary officer, to fill the next boat with stores and bring them over. While Lieutenant Fremont was discussing the situation with Captain Low, the crew took the initiative in their own hands and hauled the boats out of the water; as they did so, a huge wave hit the side of *Kilby* and smashed one of the boats to pieces. Thus, Lieutenants Fremont and Loeser were unintentionally stranded aboard *Kilby* for the night.

During the night the weather turned foul again, to the mounting dismay of the rescued passengers who suddenly realized that the frail and leaky *Kilby* was a much less secure haven than the battered but stalwart *San Francisco*. At about ten o'clock, the connecting hawser snapped and the two ships began to drift apart. By dawn they were out of sight of each other.

The situation aboard *San Francisco* was now more desperate than ever. There were about 325 troops, and 100 women and children left aboard in the charge of three officers, Major Wyse and Lieutenants Winder and Chandler. A southwest gale was raging and many of the men were too sick, too exhausted, or too despondent to obey orders. Cholera was rampant and the stink of the dead and dying victims permeated the hold. In spite of this, the officers continued to encourage and inspire their men and found enough volunteers to persevere with the job of bailing and lightening ship. Since all hope of starting the engines had been abandoned, much of the time was spent heaving coal overboard.

At 2 A.M. on New Year's Day, the young fourth officer, Mr. Mason, suddenly let out a cry of excitement. He had spotted a ship off the bow! She was *Three Bells* of Glasgow.

Captain Crighton, the master of *Three Bells*, steered his ship so close to *San Francisco* that, in the words of Mr. Auchinleck, the ship's engineer, 'I could have thrown a biscuit aboard.' But though the two ships

8. The spelling of the name of Captain Low appears erratically in the *New York Daily Times* as 'Low' or 'Lowe.' I have chosen to use 'Low.'

tried to hail each other, nothing could be heard above the din of the storm.

A message was written, wrapped around a wheel nut bolt, and thrown across to *Three Bells*. It said, 'Will you charter your ship? We are loaded with men, women and children. Name your price.'

A man picked up the message and ran to Captain Crighton, who opened it eagerly. It is reported by a lady passenger aboard *Three Bells,* a Mrs. Smith who was standing next to him as he read it, that he at once remarked: 'What does the man mean? It's not money I'm after—I'm stopping for humanity's sake.' He promptly circled his ship to windward and stood by for the rest of the night. (Vol. III, no. 727, 16 January 1854, p. 8, col. 2.)

Three Bells, an iron-hulled clipper ship, was still hard by in the morning, but the patience of the *San Francisco* survivors was yet to be tried. The weather was so bad and the seas so monstrous that no boats could be lowered. Nevertheless, Captain Crighton, sailing under *San Francisco*'s lee, threw a message across saying, 'My ship is making 4 inches of water an hour; my fresh water is also getting short so that you will see the necessity on your part of bringing provisions and water with you.' As the two ships passed close by to each other, he shouted to Captain Watkins, 'I'll stand by you till I sink!' He then remained in company with *San Francisco* for the next four days.[9] On the night of 3 January 1854, another ship, *Antarctic,* under Captain Stouffer, came on the scene and she, too, stood by through the next day. All that was needed now was for the weather, which had been blowing a gale for thirteen consecutive days, to moderate.

Meanwhile, aboard *Kilby,* a conference of officers was called to determine what should be done about the missing *San Francisco*. According to the sworn statement of Lieutenant Murray, he 'understood Colonel Gates to advise that they were in a crippled ship, short of provisions and that we should run for the nearest port and send assistance to the steamer: that proposition, I believe, was made to him by the Captain of the vessel.' However, Lieutenant Murray and some of the younger officers voted to press the search for *San Francisco*. It was finally agreed to continue to look for her until the following day (11 February 1854).

When nothing was seen of *San Francisco* by the evening of 31 December, Captain Low decided that there was no alternative but to run for the nearest port. *Kilby* was desperately short of water and provisions and all aboard were immediately rationed to one biscuit, two slices of bacon, and two gills of water a day. Conditions were appallingly crowded, many were sick with exhaustion, and the situation was aggravated by the plight of several of the children who had contracted measles.

Hopes that *Kilby* could run to port in a couple of days were soon dashed. Though the gale had abated, the breeze was still very strong. With no replacement canvas at his disposal, Captain Low did not dare to make much sail and hardly any headway occurred for a week. He had actually been on his way to Boston for refit. Heavy cloud cover compounded Captain Low's problems, making it impossible for him to take any observations to pinpoint his position.

Several times *Kilby* approached the United States coast, only to be driven back by adverse winds. On one occasion, the ship was in sight of Nantucket Shoals but had to stand out to sea again, for fear of running aground.

By 11 January *Kilby* was still at sea and the crew was becoming mutinous. On that day, Lieutenant Fremont found two sailors in the galley, which was off limits to all except the officer of the day. When he ordered them out, they bluntly refused. Lieutenant Fremont called for the corporal of the guard to arrest them and insisted that the captain place them in irons. When the remainder of the crew rallied round their comrades, an instant mutiny was avoided only by the captain persuading the lieutenant to back off.

Next day the surly attitude of the crew came to a head. The ship made a landmark off Sandy Hook in the evening but, under a violent northwest wind, Captain Low decided that he could not risk going any closer to shore in the dark. When he gave orders to change course and stand out to sea, the crew refused to obey. Lieutenant Murray intervened on the captain's behalf and finally extorted a compromise: they would obey orders on condition that, regardless of consequences, the ship would run for the nearest shore at 8 A.M. the following morning.

Ironically, those who had been forced to stay aboard *San Francisco* were to be the first to reach safety. The weather moderated enough on 4 January to embark some eighty passengers on *Three Bells*. By sunset of 5 January, all troops and passengers had been taken off *San Francisco* and distributed between *Three Bells*

9. Stackpole, p. 63.

and *Antarctic*. Captain Watkins was the last to leave, after arrangements had been made to scuttle his ship. *Antarctic* headed for Liverpool with Captain Watkins, 192 troops, women, and children, two army officers and some ship's company, while *Three Bells* set sail with the remainder for New York.

Fortunately for Captain Crighton, *San Francisco*'s engine room staff elected to sail with him. They soon diagnosed the cause of his ship's leak and had it repaired in half an hour.

Three Bells finally docked in New York at 4:30 P.M. on Friday, 13 January 1854, amid general rejoicing. All the survivors were unanimous in their gratitude to her commander who had laid by them and shared their ordeal for six days, despite his leaking ship and shortage of provisions. Asked by a *Times* reporter to comment on Captain Crighton, one of the officers was reported to have replied 'with feeling and emphasis and his eyes watered as he spoke ''He is a gentleman, God bless him—he is a gentleman!'' ' (Vol. III, no. 726, 14 January 1854, p. 1, col. 3.)

The same Friday the 13th was also *Kilby*'s lucky day. At about 7 A.M.—none too soon, considering Captain Low's 8 A.M. bargain with his mutinous crew—a ship was sighted close by in thick fog. Captain Low immediately hailed her and she identified herself as *Lucy Thompson*. Within a few minutes her master, Captain Pendleton, had agreed to take off all *Kilby*'s passengers and the embarkation proceeded throughout the day. Ropes, sails, and provisions were transferred to *Kilby* and Captain Pendleton promised Captain Low to send a tug to tow him into port.

Considering the long tale of misfortune which had befallen the *Kilby* survivors, the chance which brought them in contact with *Lucy Thompson* on that fatal Friday the 13th was a slim one. According to Captain Pendleton, he had intended to get up to Sandy Hook as soon as possible, but had been forced by the fog to lay at anchor for the night. Impatient to get moving, he had ordered his steward to call him very early, which the steward did. For the first time in his career, the captain had turned over and gone back to sleep. Had he not been, as he described himself, 'so negligent of his duty,' *Lucy Thompson* would have been long gone when *Kilby* passed her way.

Lucy Thompson set sail for Sandy Hook and anchored that night quite close to shore, giving the passengers their first view of land in a long time. In the morning, a steam tug, *Titan*, came alongside, loaded with warm clothing and provisions. It had been dispatched by *San Francisco*'s owner, Mr. W. H. Aspinwall, to bring the survivors ashore. An hour later they at last set foot on dry land in Brooklyn. It was 14 January 1854, sixteen days since they had abandoned *San Francisco*.

Last to be accounted for, *Kilby* entered Boston on 17 January 1854 in tow of the steamer *City of New York*.[10] Finally, the long ordeal was over. Two hundred forty-six people had died in the disaster—4 officers, 170 soldiers and 72 civilians: of these, some 60 deaths were attributable to cholera.

Now it was time to salute the heroes, Captains Crighton, Stouffer, and Low. Congress recommended that the president of the United States give each man a gold medal 'with suitable devices.' Baltimore, Boston, and Philadelphia voted them gala receptions and cash awards. The city of New York passed a formal vote of thanks and instructed the mayor to confer the freedom of the city on Captain Crighton. The merchants and citizens of New York paid each captain a cash award of $2,500 and presented him with a silver urn.

If one hero seemed to catch the public imagination more than the others, it was Captain Crighton. It was certainly not because he pushed himself forward. In fact, an editorial in the *New York Daily Times* of 16 January said: 'Of Captain Crighton, of the ''Three Bells,'' no words can speak too highly. He is a hero deserving the highest honors of a public reception. He shrinks, however, from public notoriety. . . .'

Perhaps it was his modesty which appealed, perhaps his good looks. Certainly he was showered with offers of marriage, requests for public appearances, and even had a song, 'Three Bells Polka,' dedicated to him.[11]

The beautifully designed silver urn which he received was fashioned by master silversmiths, Ball, Black and Company, and bore the following inscription:

Presented to Captain Creighton of the British ship Three Bells of Glasgow by the Merchants and citizens of New York as a testimonial of the high sense which they entertain of his humane, generous and heroic conduct in saving the passengers, officers and crew of the steamship San Francisco in their perilous exposure on the Ocean after the destructive gale of 24th December, 1853.

10. Ibid., p. 65.
11. T. J. Cook, 'Three Bells Polka' (New York: Berry & Gordon, circa 1854).

Silver urn presented to Captain Crighton of ship *Three Bells* by merchants and citizens of the city of New York.

The urn, unblemished by the minor misspelling of Captain Crighton's name, is still in the possession of his great-grandson, the author.

In many ways it would have been in everyone's best interests if the story of the wreck of *San Francisco* had closed on this happy note. But many lives had been lost and there were those who were determined to bring to account the individuals responsible.

None was more zealous in his resolve to expose the man whom he cast as the arch villain than Captain Gardiner of the First Dragoons. He wrote a letter to army headquarters specifically accusing Colonel Gates of dereliction of duty.

Called upon to comment on the accusation, Colonel Gates reacted with haughty indignation. He wrote a letter to Col. Samuel Cooper, adjutant general, on 24 January 1854:

Colonel,

Having been informed by Captain J. M. McDowell of the staff of the General-in-Chief, that a communication under the hand of Captain Gardiner, of the Dragoons, has been addressed to him a few days since which reflected disrespectfully upon my fair reputation as the commanding officer of the Third Regiment of Artillery, and which I here declare to be an act of great injustice to me, I have the honor of requesting that a Court of Inquiry may be ordered that ample justice may be done to me in relation to that complaint.

I have the honor to be your obedient servant.

W. M. Gates, Colonel Third Artillery. (Vol. III, no. 747, 8 February 1854, p. 8, col. 1.)

As events transpired, Colonel Gates's request was a reckless one. A court of inquiry was indeed convened and it opened an avenue of attack which Colonel Gates must have overlooked: his own officers, who might have placed the honor of their regiment above their criticism of their commanding officer, now felt no compunction in expressing their true feelings when questioned under oath.

The court of inquiry held its first session on 6 February 1854 at 114 West Eleventh Street, New York, the headquarters of General Scott, commander-in-chief of the United States Army. It continued in session for seventeen days and completed its task on 25 February. Sessions were open to the public and a verbatim account of the entire proceedings was reported daily in the *New York Daily Times*.

The order convening the court was read by Major Lee as follows:

War Department. Jan. 27, 1854. By direction of the President of the United States, a Court of Inquiry will convene in the city of New York, on Monday, the 6th day of February 1854, or as soon thereafter as practicable to examine into all the circumstances attending the embarkation in December last, of the troops under the command of Col. William Gates, Third Artillery, on board the "San Francisco" destined for California; the cause of the failure of the expedition and of disorganization of the command at sea; and all the facts and circumstances which may concern the conduct of the commander, and of the officers and men of the command.

The court will be composed of Major-General Winfield Scott, Commanding the Army; Brevet Brigadier-General Henry Stanton, Assistant Quartermaster-General; Brevet Colonel E. V. Sumner, Lieut. Colonel First Dragoons; and

Brevet-Major John F. Lee, Judge Advocate of the Army, as recorder.

The court will make a full report of the facts in this case, with their opinions.

Signed - Jefferson Davis. Secretary of War. (Vol. III, no. 746, 7 February 1854, p. 8, col. 1.)

There were no startling disclosures during the first two days; most of the evidence concerned the chartering and loading of the vessel.

On the third day, Lieutenant Fremont was on the stand when he was asked to 'state the circumstances in regard to Colonel Gates's leaving the "San Francisco" to go aboard the "Kilby" ' (7 February 1854).

Fremont replied with a lengthy description of the circumstances, almost as though he were afraid to give a direct answer. Finally, he got to it. 'Col. Gates,' he said, 'went in the first boat after the detail had left, leaving Major Wyse who had been previously detailed to superintend the transfer from the steamer.'

On the seventh day, Major Wyse was placed on the stand and hotly denied that Colonel Gates had turned the command over to him. His evidence could hardly have been more damning:

Question (from the court): What neglect of his duty as commander of the regiment do you impute to Col. Gates? State the facts.

Answer (Major Wyse): From the 24th December 1853 up to the 28th . . . Col. Gates neglected to have proper details made for bailing the ship and lightening her of cargo; he also failed to take that interest in the safety and comfort of his men which became a commander in such circumstances.

Question: Can you be more specific in your general opinions on the subject?

Col. Gates: Allow me to remark that the witness was required to state facts.

General Scott: Undoubtedly facts are called for, but opinions upon facts I do not understand to be excluded by rules of the court.

Witness resumed: I would further state that had he been a citizen passenger, he could not have taken less interest in that command than he appeared to do.

General Scott: Enumerate any instances of neglect.

Answer: I cannot state individual instances of neglect where I did not notice a single particle of duty done by the commander, and I had ample means of seeing and knowing the duty if it had been done. I will now further specify that on the 25th December . . . Col. Gates neglected then to set his quartermaster and commissary to getting out water and provisions . . . and transporting them to the bark 'Kilby': he also neglected to have a minute inspection of the command by his medical officers, and to have the sick and invalids . . . transferred to the 'Kilby': he also neglected to retain Capt. Judd on board . . . when he commanded . . . two companies of raw recruits, which rendered his presence . . . extremely essential. He neglected to retain on the wreck the Regimental Quartermaster, Lieutenant Fremont, the Commissary of Subsistence, Lieut. Loeser, and the assistant-surgeon Dr. Wirtz: he also neglected to inform the next senior who was left on the wreck that he was about to leave the ship, nor did he turn over to that officer one single instruction or expression in reference to the command. . . . (Vol. III, no. 752, 14 February 1854, p. 3, col. 1.)

Previous to this bitter attack by Major Wyse, other incriminating evidence had been presented which might have been suppressed had not the officers been under oath. On the fourth and fifth days Lieutenant Fremont and Doctor Saterlee recounted the happenings at Judson's Hotel when the matter of his son's measles was brought to the attention of Colonel Gates. On the sixth day, Captain Gardiner was on the stand and he was questioned about Colonel Gates. He answered variously:

On *San Francisco:*

. . . I heard him give no orders and I did not see him do anything. . . .

I heard him give orders . . . to bring him food and water. . . .

I heard him say 'I shall be the last man to leave the ship'. . . .

On *Kilby:*

Col. Gates had an extra quantity of water, each time I was officer of the deck . . . I remonstrated with him. He [replied] I don't give a damn for the men—I would rather twenty of them should die, than my child should suffer. . . . (Vol. III, no. 751, 13 February 1854, p. 3, col. 2.)

For the next few days the taking of evidence proceeded without any noteworthy developments. Much of the matter dealt with the basic routine aboard *Kilby*, and the transfer from *Kilby* to *Lucy Thompson*. Colonel Gates called two witnesses on 20 February to testify on his behalf: Sergeant-major Graham said he had seen Colonel Gates securing the forward hatchway on *San Francisco;* Corporal Smith attested to seeing Colonel Gates secure a lifeline and being present when Colonel Gates showed some of the men how it was done.

On the fourteenth day of the court of inquiry, Captain Watkins, recently returned from Liverpool, took

the stand. Generally, his evidence was favorable to Colonel Gates. He stated that Colonel Gates had not failed to grant any aid requested and he had, on one occasion, seen Colonel Gates repairing a companionway and on another, nailing oilcloth over a hole in the deck.

Then suddenly, there was a surprise development. During a lull in proceedings, the judge advocate, Major Lee, announced that he would read into the record Colonel Gates's charge against Captain Gardiner.

The charge was 'disgraceful conduct.' It accused Captain Gardiner of 'secreting near his sleeping place [in *Kilby*] from ten to twelve whole biscuits, which he had taken for his own use from the depository. . . .' The charge was signed by Colonel Gates and witnessed by Sergeant McIntyre and Privates Sleeper, Selby, Eldridge, Murphy, and Adams. (Vol. III, no. 759, 22 February 1854, p. 3, col. 5.)

The ensuing events were so bizarre that, if they had not been solemnly recorded in the *New York Daily Times*, they would defy credulity.

First, Major Lee read into the record a long statement by Captain Judd (who had slept next to Captain Gardiner on *Kilby*) explaining in essence that the biscuits were his; that he and his wife suffered from dyspepsia; and, that they did not consume *all* the biscuits allocated to them in normal course and instead hoarded some against future need.

There followed another letter from Colonel Gates, this time stating that he had taken

> measures to find the cook of the vessel (*Kilby*) who was well acquainted with the circumstances of the case. Upon questioning the cook, he flatly sustained the accusation which had been made, and this in the presence of witnesses. Accordingly, he was requested yesterday to appear to give in his testimony. He came and was accosted by Captain Gardiner and informed by him that he would not be required that day, and when wanted, he [Captain G.] would notify him, giving him, as I am informed, some money at the same time. . . .

Colonel Gates appealed to the court to find the missing witness.

The court now considered whether it was within its mandate to hear the prosecution of the charge and decided it was. Colonel Gates then announced he could not proceed because his witnesses were not present.

Captain Gardiner then stood up and pointed out that the ship's cook *was* present!

After some confusion, Colonel Gates asked permission to withdraw the charges, saying that the cook seemed to have changed his testimony and could not be relied upon.

Captain Gardiner now objected to the withdrawal of the charges unless Colonel Gates admitted they were false.

After more altercation, the cook was called. Colonel Gates objected and was overruled by the court. The cook, Frederick Lincoln, was then sworn in. Colonel Gates objected that *he* did not bring the witness.

General Scott then asked Colonel Gates if this witness was the one referred to in his letter. Colonel Gates 'not making such answer as the court understood,' the court ordered Major Lee to read the letter, which he did. Colonel Gates then admitted that this was indeed the witness.

The court now questioned Frederick Lincoln as follows:

Question: 'Were you told to come here as a witness some days ago?'
Answer: 'Yes, I came to see Captain Watkins. I saw Captain Gardiner and asked him where Captain Watkins was. He told me that he was in Boston.'
Question: 'Did Captain Gardiner give you any money?'
Answer: 'No sir . . .'
Question: 'Did Captain Gardiner tell you not to come here . . . ?'
Answer: 'No, sir.'

After additional evidence was presented to support Captain Gardiner's innocence, the court adjourned.

Next day Colonel Gates's charge against Captain Gardiner finally disintegrated. In quick succession, Privates Sleeper, Murphy, Adams, Selby, and Eldridge denied knowledge of any evidence to support the charge against Captain Gardiner.

Colonel Gates finally retreated in confusion and requested to be allowed to withdraw his charge. But the court, perhaps offended by the affront to their dignity which had ensued from the frivolity of the charge, refused. They instructed the judge advocate to order Sergeant McIntyre, the only missing witness left, to attend court the following day.

Sergeant McIntyre did not appear. In a futile attempt to make something of his case, Colonel Gates then offered Sergeant Horn as a witness to prove that Captain Gardiner had told Frederick Lincoln that he would not be wanted in court and that if he was, Captain

Gardiner would send for him. Sergeant Horn then took the stand. He was asked: ' ''Do you know anything about Capt. Gardiner's using means to keep away Frederick Lincoln from appearing here as a witness?'' *Sergeant Horn:* ''No, sir.'' ' (Vol. III, no. 761, 24 February 1854, p. 3, col. 3.)

On the last and seventeenth day, Sergeant McIntyre appeared. As might be expected, he followed the long line of witnesses who had put the lie to the charge against Captain Gardiner. The proceedings concluded with a long statement by Colonel Gates which was read to the court by his counsel, Captain Shields.

It opened with an outraged portrayal of injured innocence. Colonel Gates found himself, it said, 'charged with being the author of more direful outrages than were ever attributed to the many-headed monster Peleponnessus.'

> 'I am depicted (he continued in fustian prose) as the wretch in human form who would spread a deadly contagion among his fellows . . . as the selfish and heartless tyrant who was rioting in stately and luxurious apartments while those claiming his care were freezing in the wintry blast . . . as the sluggard who . . . folded his arms and refused all advice and assistance . . . as the heartless tyrant who stealthily seized the first opportunity of escape and . . . set sail and left his comrades to peril in the deep . . . as the gluttonous wretch, while faring sumptuously every day . . . and sullenly refusing the entreaties of his starving men, invokes curses and imprecations on their heads.' (Vol. III, no. 762, 25 February 1854, p. 3, col. 1.)

He then referred to the favorable evidence presented by his own witnesses, including, somewhat naively, Major Wyse. He referred to the death of his eldest son and admitted 'the crime—if crime it is' of bringing another son aboard with the measles.

In regard to his departure to *Kilby* without giving Major Wyse any specific orders, Colonel Gates presented an ingenious if specious argument. 'Had I intended to relinquish my command to Major Wyse,' he said, 'I would have informed him; but, retaining as I did the command of both vessels (for they were fastened together by a strong hawser and were, to all purposes, one and the same) I conceived no such form necessary. . . . '

He concluded flamboyantly by picturing the wreck as 'an event which could only have been controlled by the power of Him Who plants his footsteps on the sea and rides upon the storm' and placed himself at the mercy of the court.

The court then went into secret session and adjourned *sine die*.

The findings of the court were published in the *New York Daily Times* of 12 June 1854.

The court found that there was

> blameable disorganization at the head of the command—not the result of panic or physical incapacity, for Colonel Gates, notwithstanding the loss of an interesting son, seems to have been cool and quite active on foot: but disorganization resulting from fatuity or crookedness of mind, which leaving him alive to his own immediate wants and those of his family, and to the first accidental chance of escape, caused him to neglect nearly every high duty imposed by his rank. . . .

There was no formal sentence, since the examining body was constituted as a court of inquiry rather than a court-martial. Nevertheless, following the court's findings, Colonel Gates was ordered to transfer his command to Major Wyse.

It could reasonably be expected that this was the end of the *San Francisco* affair; certainly its newsworthiness was exhausted and the story slipped from the front page of the *Times*. But there was an ironic postscript to be written.

The United States Army had a grand design for the deployment of its forces which involved the stationing of the Third Regiment of Artillery in California; it was not to be deterred from this design by the loss of a few hundred troops. To California the luckless Third would go.

Arrangements were made for the troops to travel by regular mail ship on 18 April 1854, and meanwhile Major Wyse, the new commanding officer, went on leave. Upon his return, he was perplexed to find that, even though the mail ship, *George Law*, was in port, embarkation orders had been changed and the troops were to sail in an older ship called *Falcon*.

On the appointed day, the *San Francisco* survivors marched once more to the New York dockside, with Major Wyse at their head. Almost as soon as he set eyes on *Falcon*, Major Wyse called a halt. He strode aboard, inspected the ship, pronounced her unseaworthy and refused to order the troops aboard. He was promptly arrested and confined on Governor's Island to await court-martial. *Falcon* left without him. (Vol. III, no. 813, 26 April 1854, p. 4, col. 2.)

That Major Wyse had some grounds for his misgivings about *Falcon*'s seaworthiness is evidenced by an editorial in the *New York Daily Times* of 8 May 1854 which stated that 'the evidence given on the trial of Major Wyse for refusing to order the troops under his command to go to sea on board the ''Falcon'' shows conclusively that the steamer ought never to have been chartered by the Government for such a service.' It went on to say, 'we think the public will hold Major Wyse justified in the course he adopted. . . .'

The United States Army was not as sympathetic as the public. Major Wyse was arraigned before a court-martial on 22 April 1854 under the presidency of Brig.-Gen. Henry Stanton, and was charged on two counts: 1) Disobedience of Orders; and 2) Conduct unbecoming an officer and a gentleman.

The findings of the courts were published in a column of the *New York Daily Times* of 12 June 1854, which, by an astonishing twist of irony, was in juxtaposition with the column announcing the findings of the previous court of inquiry on Colonel Gates. Major Wyse was found 'Guilty' of the first charge and 'Not Guilty' of the second. He was sentenced to be dismissed from the service.

But there was an eleventh-hour reprieve. The secretary of war, in a marvelously ambiguous statement, said that the president of the United States had duly confirmed the sentence and then—'in consideration of the unanimous recommendation to Executive clemency of the officers composing the Court Martial'—had mitigated it to suspension of rank, command, and pay for six months.

In a fitting epilogue—to which every passenger of *San Francisco,* alive or dead, would surely have subscribed—the secretary went on to say that 'due care and judgement have not in all cases been exercised in the selection of transports for troops. . . .'

'Officers of the Quartermaster's Department,' he continued, 'entrusted with the selection of army transports, and Military Commanders charged with the embarkation of troops, are enjoined to use in every case all practicable means to procure vessels entirely seaworthy and proper for such service.'

The story concluded with a final sardonic twist:

'On termination,' the court had proclaimed, 'of the period for which he is suspended, [Major Wyse] will proceed to join his company wherever it may then be serving.'

Wyse did not have far to go. After a week at sea, *Falcon* broke down and limped into Norfolk, Virginia. Once more, the long-suffering Third disembarked onto *terra firma,* and was promptly dispatched to quarters at Fort Monroe, Charleston. (Vol. III, no. 813, 26 April 1854, p. 4, col. 2.)

Author Richard Crighton is the great-grandson of Captain Crighton of the ship Three Bells, *hero of the* San Francisco *rescue. Born in England and a citizen of Canada, Crighton owns a two-hundred-year-old cottage in Castine, Maine, where he plans to retire and write. After a long and varied career as naval officer, attorney, salesman, marine agent, oil executive, advertising man, marketing vice-president and civil servant, Crighton turned to writing in 1981 when his first novel,* The Million Dollar Lift, *was published. Since then, he has written a second novel,* Red for Terror *and a number of articles.*

Arming the Fleet: Early Cannon Founders to the United States Navy

By Spencer C. Tucker

ALTHOUGH the British discouraged the manufacture of cannon in the American colonies, the colonial iron industry developed rapidly. Iron ore as good as any in Europe, Sir Thomas Gates reported in 1610, could be found on the surface.[1] Heavy British and colonial demands stimulated exploitation of this source.

The first forge in the New World was built in 1619, at Falling Creek on the James River below Richmond.[2] The first permanent furnace was established at Braintree, Massachusetts in 1644.[3] British need for iron was increasing as iron cannon were replacing those of bronze, and the wars of the period created a considerable demand. At the same time the English forests were rapidly becoming denuded, making charcoal scarce. An iron furnace used a vast quantity of wood; in the eighteenth century it took three tons of ore and 250 bushels of charcoal to make a ton of iron.[4]

Although the colonial iron industry did not make great progress in the seventeenth century, it expanded in the eighteenth owing to the steadily increasing demand for iron.[5] But the British government and merchants did not welcome American competition and in 1750 the Iron Act passed by Parliament abolished new iron rolling and slitting mills, and restricted the sale of finished iron products to the colonies in which they were made.[6]

Such regulations were evaded, however; whereas only 1,130 tons had been exported from the colonies in 1730, the total by 1770 was 7,500 tons annually.[7] By 1775, according to one source, 'the continental colonies were producing about one seventh of the world's supply of iron, and their production of pig and bar iron exceeded that of the mother country.'[8]

It will never be known with any certainty who cast the first cannon in North America, but it may have been Henry Leonard of Lynn, Massachusetts in 1647.[9] By 1702 a furnace had been established at Plymouth County, Massachusetts, which produced cannon balls along with hollow-ware,[10] and in 1710 a works was built near Abington and Hanover, Massachusetts which, under Col. Aaron Hobart, cast cannon and shot during the Revolution.[11] The Hope Furnace in Rhode Island cast cannon during the French and Indian War of 1754-1763.[12] Hugh Orr, a native of Scotland who arrived at Bridgewater, Massachusetts in 1738, soon set himself up in the iron trade in that area. In 1748 he produced 500 muskets for the Massachusetts Bay Colony, believed to have been the first manufactured in America on a large scale. During the Revolution, the State Furnace was erected under his direction.[13] Orr may have been the first to introduce to America the boring machine developed by Johann Martiz of Switzerland in 1715.[14] In any case, boring machinery was installed in Orr's Bridgewater foundry, and he produced a number of cannon during the Revolution.[15]

1. J. Leander Bishop, *A History of American Manufactures from 1608 to 1860*, 3d ed. (Philadelphia: Edward Young and Co., 1868), I, 468.
2. Horace Greeley et al., *The Great Industries of the United States* (Hartford: J. B. Burr & Hyde, 1872), p. 355. Oscar T. Barck and Hugh Talmage Lefler, *Colonial America* (New York: Macmillan, 1968), p. 349.
3. E. N. Hartley, *Iron-Works on the Sangus* (Norman, Oklahoma: University of Oklahoma Press, 1957), pp. 100-4.
4. James M. Swank, *History of the Manufacture of Iron in all Ages, and particularly in the United States from Colonial Times to 1891* (Philadelphia: The American Iron and Steel Association, 1892), p. 129.
5. Arthur C. Bining, *Pennsylvania Iron Manufacture in the Eighteenth Century*, Publications of the Pennsylvania Historical Commission, IV (Harrisonburg, Pennsylvania, 1938), 19.
6. W. Kenneth Howell and Einar W. Carlson, *Men of Iron: Forbes & Adam* (Lakeville, Connecticut: Pocketknife Press, 1980), p. 8. And Barck and Lefler, *Colonial America*, p. 233.
7. Robert E. Gardner, *Five Centuries of Gunsmiths, Swordsmiths and Armourers, 1400-1900* (Columbus, Ohio: Walter F. Heer, 1949), p. 109. See also *Records of the Columbia Historical Society, Washington, D.C.* (Washington, D.C., 1908), II, 17.
8. Barck and Lefler, *Colonial America*, p. 350.
9. Bishop, *American Manufactures*, I, 482.
10. Ibid., I, 485-86.
11. Ibid., I, 485.
12. Robert E. Gardner, *Arms Fabricators, Ancient and Modern* (Columbus, Ohio: F. J. Heer, 1934), p. 110.
13. Bishop, *American Manufactures*, I, 486. Sanders and Gould note that the foundry was capable of casting up to 24-pounders and that Paul Revere learned brass founding there. Clyde A. Sanders and Dudley C. Gould, *History Cast in Metal. The Founders of North America* (Cast Metals Institute, American Foundrymen's Society, 1976), pp. 404-10.
14. Melvin H. Jackson and Charles de Beer, *Eighteenth Century Gunfounding* (Washington: Smithsonian Institution Press, 1974), p. 16.
15. Bishop, *American Manufactures*, I, 486.

When the American Revolution began, the colonial governments ordered the casting of cannon locally. It is impossible to ascertain how many colonial foundries produced how many cannon for the American cause during the Revolution, and even more difficult to ascertain which founders were involved in casting guns for the navy. Among those founders mentioned as producing guns for sea service, however, are the Drink-Water Iron Works, Abington, Massachusetts; Hope Furnace, Hope, Rhode Island; and Salisbury Furnace, Salisbury, Connecticut. Although the cannon cast were often of indifferent quality, the numerous colonial forges made an important contribution to the American cause in the Revolution.

In the years following the Revolution there was a falling off in orders for cannon. The military and naval establishments were virtually dissolved, but the United States could not ignore the need for a navy, and by the mid-1790s cannon were again being produced for the federal government. By the end of the first half of the nineteenth century the manufacture of cannon in America came to be highly specialized and centered in a few foundries.

On 27 March 1794 Congress authorized the construction of six frigates for the navy. Their arming required several hundred cannon, the majority long 24-pounders. These cannon were duly cast, albeit with some delay and difficulty. Two contracts for these guns, let for the United States Navy under the new federal government of the United States, were signed that same year. They were with Samuel Hughes, who owned Cecil Co., Cecil County, Maryland, for casting fifty 24-pounders and 'Messrs. Brown and Francis and others' of the Hope Furnace, Rhode Island, for casting sixty 24-pounders. For the guns the United States government would pay $106-⅔ per ton plus an allowance 'for the extra expense of boring from the solid metal.'[16] Twenty-eight of the guns cast in clay molds by Hughes went to arm frigate *Constellation* and were used in the capture of French frigate *L'Insurgente*. In 1808 Hughes wrote of these early guns—'their principal fault is in the draft, and compared with the guns since cast in dried sand and from improved drafts they appear to great disadvantage.'[17]

16. U.S. National Archives, Record Group 45, Entry 235, I, 1-7. Also, U.S. Congress, *American State Papers, Military Affairs*, I, 123. (Archives Record Groups hereinafter cited as RG; Entries as E.)

17. After the capture of *L'Insurgente* Captain Truxtun offloaded the Hughes-cast guns as being too short and too heavy. U.S. National Archives, RG45, M-124-1808-VI, 85-86.

Brown was apparently a man who could drive a hard bargain. Secretary of the Navy Benjamin Stoddert informed Captain Talbot, who was to purchase shot from the founder, that 'Mr. Brown, who Seems to be a complete Master of the Art of bargain making will probably ask more. — You must do the best you can with him, and let the public be Screwed as little as possible.'[18]

In this early period, considerable difficulties were experienced not only because founders were slow in fulfilling their contractual obligations but also because of the poor quality of the guns produced. Fairly typical is the experience with guns cast by Brown for frigate *George Washington,* launched in 1798. Although the 6-pounders were 'successful,' most of the 9-pounders 'burst in the proving' and Captain Fletcher of the frigate was reluctant to receive the others on 'account of the general bad quality of the metal.'[19]

It may have been difficulties with the private founders which induced Congress to consider the establishment of a national foundry for the casting of cannon both for the army and navy. Marshall Smelser has ably dealt with this subject, which was much discussed in the period 1795-1800. Nothing came of the project other than the eventual establishment of the Harpers Ferry arsenal, which was not involved in casting cannon.[20]

In the 1790s there were five firms casting guns for the navy. Hughes, and Brown and Francis were the first two. The third was David Waterman, who operated the Salisbury, Connecticut foundry. In 1798 Waterman received a contract to cast guns for one of the new frigates, possibly *Chesapeake* or *Congress*, which were launched in 1799 and 1800 respectively.[21]

At the end of 1798 Secretary of the Navy Stoddert announced that he needed 'for the Present Navy Establishment' a total of 396 guns, and he proposed to enter into a contract with the fourth foundry of this period,

18. Letter of 20 September 1798 in U.S. Navy Department Office of Naval Records and Library, *Naval Documents related to the Quasi-War between the United States and France. Naval Operations from February 1797 to October 1978* (Washington: U.S. Government Printing Office, 1935), p. 428. (Hereinafter cited as U.S., *Quasi-War Docs.*)

19. Letter from Secretary of State Timothy Pickering to James and Ebenezer Watson, navy agents in New York, 14 November 1798. Ibid., *Naval Operations from November 1798 to March 1799* (Washington: U.S. Government Printing Office, 1935).

20. Marshall Smelser, *The Congress Founds the Navy, 1787, 1798* (South Bend, Indiana: University of Notre Dame Press, 1959), pp. 139-41. See also U.S., *Quasi-War Docs., Naval Operations from January 1800 to May 1800* (Washington: U.S. Government Printing Office, 1937), pp. 291-92.

21. U.S. National Archives, RG217; also RG45, #235, I, rl-42; and RG45, E265, I, 34-35.

William Lane of Philadelphia and William Salter of New Jersey. Lane and Salter were to produce in all $23,000 worth of cannon, approximately one-third the number required.[22] By this time the price paid for guns was $133.33 per ton for the 18- and 24-pounders and $150 per ton for the 6-, 9-, and 12-pounders.[23]

The fifth founder was Henry Foxall, who became the key figure in cannon manufacture in the United States at this time. Foxall operated the Eagle Foundry on the Schuylkill River at Philadelphia, in partnership with Richard Morris, Jr., son of the financier of the American Revolution.[24] Foxall perfected a boring machine for cannon, later copied by Hughes, and Lane and Salter. He is also thought to have been the first to produce the short gun known as the carronade in this country.[25] In 1799 Secretary of State Timothy Pickering, taking note that the navy had agreed to purchase $50,000 worth of guns cast by Foxall, wrote that '. . . he was the first person who produced in the United States, cannon of an unexceptional quality. . . . The U. States are really indebted to him for the improvements he has introduced amongst us.'[26]

Foxall was probably casting cannon for the navy by 1798,[27] but the first known contract between the navy and Foxall's Eagle Foundry is in January 1799 for $23,000 worth of guns.[28] That same year Hughes had another contract (this time his location is given as Havre de Grace, Maryland) for 148 guns. This contract contains the first reference to 32-pounders for the navy and it and two subsequent contracts with Foxall and Lane were to provide guns for the 74-gun ships authorized by Congress in 1799.[29]

By 1799 difficulties were being experienced with cannon cast at Salisbury Furnace, and apparently this was the end of its work for the navy.[30] But if Salisbury was having difficulty with its guns, other founders were not, and by 1800 Secretary of State Timothy Pickering could express satisfaction with American-made guns. 'Our iron is of superior quality,' he wrote, 'and our foundries now very perfect. The guns will be light, as well as strong and smooth.'[31]

In 1800 a contract was signed with William Lane for 148 guns; the smallest not less than 9-pounders and the largest not greater than 42-pounders (probably the latter were carronades). Lane was to receive $130 per ton of cannon.[32] That same year an identical contract was signed with Foxall's Eagle Foundry for 148 guns. For the first time the contract included a bond ($30,000) to be forfeited if the cannon were not received.[33]

Also in 1800, Henry Foxall established a major new foundry for cannon in the village of Georgetown, outside Washington, D.C. The reason for his departure from the Eagle Foundry is unknown, but it appears that it stopped casting cannon, since there are no further references to the Eagle Foundry in the navy contracts.

The new works was known as the Columbian Foundry. Its capacity was approximately three hundred 12- to 24-pounders and some thirty thousand shot a year.[34] The works was certainly one of the largest suppliers of cannon and shot in the United States until it went out of business in 1859.

The first contract of which there is record between the Columbian Foundry and the navy is in July 1807,[35] but there are references in December 1801 to an advance of $18,000 to Foxall for guns for some of the 74s then building.[36] Records of earlier contracts have probably been lost. The 1807 contract with Foxall was for one hundred guns; another that same year with Hughes was for an additional one hundred cannon as well as shot.[37]

In August 1807 a letter from the Navy Department to Samuel Hughes authorized him to produce fifty 24-pounder and fifty 32-pounder guns, as well as a quantity of shot.[38] That same month, a new contractor

22. U.S., *Quasi-War Docs., Naval Operations from November 1798 to March 1799*, p. 58.
23. U.S. National Archives, RG45, E265, I, 50-51.
24. Ibid., RG45, E265, I, 53-56; also RG217.
25. U.S., *Quasi-War Docs., Naval Operations from November 1798 to March 1799*, p. 207.
26. Ibid.
27. In a letter of 8 September 1798 to the secretary of the treasury, Secretary of the Navy Stoddert wrote: 'I have the honor to inform you that Foxall's Works engaged in casting Cannon for the Navy, will furnish them as fast as they be wanted for the Navy. . . .' Ibid., *Naval Operations from February 1797 to October 1798*, p. 396.
28. U.S. National Archives, RG46, E265, I, 53-56; also RG217.
29. U.S. Congress, *American State Papers, Naval Affairs*, I, 79. Also RG45, E265, I, 58-59; also RG217.
30. Letter from the secretary of the navy to James and Ebenezer Watson, navy agents at New York, 19 April 1799. U.S., *Quasi-War Docs., Naval Operations from April 1799 to July 1799* (Washington, D.C.: U.S. Government Printing Office, 1936), p. 68.
31. Letter from Secretary of State Timothy Pickering to Richard O'Brien, U.S. Consul General at Algiers. Ibid., *Naval Operations from January 1800 to May 1800*, p. 77.
32. U.S. National Archives, RG45, E235, I, 89-91; also RG217.
33. Ibid., RG45, E235, I, 93; also RG217.
34. Sanders and Gould, *History Cast in Metal*, p. 390.
35. U.S. National Archives, RG45, E235, I, 296; also RG217.
36. U.S., Congress, *American State Papers, Naval Affairs*, I, 79.
37. U.S. National Archives, RG45, E235, I, 296; also RG217.
38. Ibid.

for cannon appears in the records. This was Samuel Richards of Philadelphia. Secretary of the Navy Smith agreed to purchase from Richards fifty 24-pounders and fifty 32-pounder guns, as well as a considerable quantity of shot.[39] This contract was filled,[40] but there is no record of further cannon production for the navy by Richards.

Henry Foxall continued to cast carronades for the navy in this period, but not under formal contract. Secretaries of the navy would simply write him and specify the number to be manufactured. The Richards contract of August 1807 is the last formal contract for guns until the outbreak of the war between Great Britain and the United States in June 1812. Soon the navy placed large orders for shot. Stockpiles of cannon must have been adequate, however, since the first references to cannon cast for the navy do not come until February 1813, and these were for carronades rather than long guns. In February 1813 Secretary of the Navy William Jones requested that twenty-five 32-pounder carronades 'lying at Mr. Foxall's works' be proved as soon as possible.[41] These were intended for service on the Lakes, apparently part of a shipment of thirty-seven 32-pounder carronades from Washington to arm two brigs.[42] In February and March 1813, letters from Jones to Foxall or Commodore Thomas Tingey at the Washington Navy Yard directed the shipment in groups of two or three of a total of thirty-five carronades to Pittsburgh. It is believed these were all of Foxall's manufacture. There may have been as many as fifty carronades involved.[43]

Carronades continued in demand. In May 1813 a contract was let with William H. Dorsey, Walter Dorsey, and John Dorsey of Baltimore, Maryland (referred to by 1815 as Etna Furnace) for one hundred 32-pounder carronades. That Foxall was the preferred manufacturer of carronades is shown in the contract, for it called for the guns to be 'of the exact form, size, weight, workmanship, and proof as those made by Mr. Foxall for the Navy Department.'[44] In 1813 orders for shot were also placed with Oneida Iron and Glass Manufacturing Co. and James Lyon of Richmond, Virginia.[45]

39 Ibid., RG45, [illegible]
40 Ibid., RG45, M124 1805 IX, 119 V, 88 VI, 115
41 Ibid., RG45, [illegible]
42 Ibid., RG45, E463, Ops. Letters, 1, 1813, no. 75
43 Ibid., RG45, E364, Navy Yards, no. 1, "Journal 1808-13," May [illegible]

In February 1814 a contract was let to Joseph McClung of Pittsburgh to produce carronades. This was probably the firm known as the Pittsburgh Cannon Foundry, which in the 1840s became Knap and Totten but was popularly referred to as the Fort Pitt Works. In the years ahead it became a major supplier of ordnance to both the army and the navy. Certainly the proximity of the firm to Lake Erie would be convenient because of the war then in progress. In approving the contract, Secretary of the Navy Jones wrote that he considered 'the establishment of a Cannon Foundry at Pittsburgh' as 'of great public advantage.' The contract called for the manufacture of one hundred carronades (twenty 42-pounders at $225 each, forty 32-pounders at $175, twenty 24-pounders at $133 each, and twenty 18-pounders at $100). It also included beds for the carronades, grape shot, and stools. Once again Foxall's work was the model.[46]

William Lane ceased making cannon before the War of 1812 but in February 1814 there was correspondence regarding Lane's attempt to justify $6,857 in credit for the delivery of thirty-five cannon at 'Tom's River.' Lane's dealings with the navy are hard to untangle but the dispute was evidently settled in his favor, since he received more than $37,000 for '114 cannon manufactured and delivered . . . at Philadelphia.'[47]

In May 1814 there was a contract with Enoch Hidden of New York for five hundred cannon locks (used to fire the guns), the first so noted.[48] Hidden's new lock, which underwent modifications and was ultimately patented in 1842, marked a considerable improvement over the old flintlock, and ultimately found its way into both the American and British navies.[49]

In February 1814 Secretary of the Navy Jones noted in a report, 'The cannon foundries are few in number and none of any note north of the waters of the Chesapeake.'[50] There is no mention in the contractual records of Salisbury Furnace between 1798 and 30 June 1814, when Jones wrote to John M. Holley, 'one of the proprietors of the Salisbury Furnace, Conn.' offering to have them cast for the navy fifty 32-pounders and one hundred tons of shot. This was, in Jones's words, 'In order to encourage the establishment of a

46 Ibid., RG45, E238, II, 200.
47 Ibid., RG45, E238, three entries
48 Ibid., RG45, E238, II, 202.
49 H. Garbett, Naval Gunnery: A Description of Modern Guns [illegible]
50 U.S. Congress, American State Papers, Naval Affairs, [illegible]

Cannon Foundry in the Northern section of the Union. . . .' This suggests that Salisbury had not been making cannon for some time.[51]

The contract was not accepted, however. Written at the top of the copy of this letter in the contract book is the notation, 'Messrs. Holley & Coffing, by their letter dated 20 August 1814 decline the acceptance of this Contract.'[52] Part of the problem may have been that the price offered for the guns, $133.33 a ton, was the same as in 1798. In May 1814, however, the price went up, at least to Foxall. This was justified on the basis of increased costs of coal and pig iron. Foxall estimated his expenses in this regard had increased by $20 per ton, but the Navy Department authorized only an additional $10 per ton in payments to Foxall for his work 'since the settlement of his account in March 1813.'[53]

In January 1815 a large contract for shot was signed with the New York firm of 'Joshua Forman, County of Onondago, John J. De Graff of Schenectady and James R. Clarke of Brooklyn, King's County.' It amounted to 5,931 shot of 24- to 42-pounder size and 4,050 stands of 32-pounder grape.[54]

Although Foxall's casting is repeatedly cited as the standard of quality for the other founders of this period to meet, the only reference to guns cast by the Columbian Foundry during the War of 1812 is for the 32-pounder carronades of 1813, and this was not in a contract. One can only speculate that Foxall continued to cast cannon for the navy, although there is no formal evidence of this in the contract books available. Indeed, few orders for cannon from any founders appear for this period. Perhaps the records were destroyed in the British raid on Washington or there may already have been sufficient guns on hand, for most of the navy's seagoing vessels were blockaded in port by the Royal Navy.

Founders other than Foxall finally appear in the contracts, but not until the end of the war. On 14 January 1815 a contract was let with Peter Townsend 'of the County of Orange and state of New York' for four hundred tons of cannon and carronades 'of such calibres and forms, and in such quantities of each with beds for the Carronades complete, as the Navy Department shall direct.' The price schedule for the carronades ranged from $58.75 each for the 12-pounders to $200 each for the 42-pounders.[55]

In March 1815 a contract was let for 175 tons of cannon and carronades to John Clarke and William Wirt of Richmond, Virginia. Once again, Foxall's work was the example.[56] The principal figure in this venture was Maj. John Clarke, and his works is subsequently referred to in contracts as John Clarke & Co., and later as the Bellona Furnace or Foundry.

Clarke had been in charge of the construction of the Virginia Manufactory of Arms, located at Richmond. In 1808 appropriations from the Virginia General Assembly had allowed the erection of a foundry for cannon on the premises of the state armory. Foxall was consulted and apparently made and set up the principal apparatus 'for casting, boring, and turning cannon. . . .'[57] No cannon for the federal government were ever produced there. Possibly the cannon-making machinery was sold to John Clarke; he had left the foundry in 1809 and established his own works in Powhatan County. Cromwell gives the date for the start of the Bellona Foundry as 1816, but Clarke's first contract with the navy, listed above, was a year earlier.[58]

A second reference to the contract with Clarke and Wirt lists also 175 tons of shot: round, grape, and cannister.[59] On 20 March 1815 a contract was let for three hundred tons of 32-pounder shot with John E. Dorsey of Etna Furnace, near Baltimore.[60] This is the last contract of the War of 1812 period.

Henry Foxall sold the Columbian Foundry to Gen. John Mason in 1815. A year later Mason had his first contract with the navy,[61] and the Columbian Foundry continued in operation until the mid-1850s. The first contract with a new firm, the West Point Foundry Association, also came in 1816.[62] (It was twenty years later that Robert P. Parrott, inventor of the Parrott rifled gun of Civil War fame, became superintendent of the W.P.F.A.) Cyrus Alger of Boston, whose works was known by his name and also as the South Boston Iron Works, had his first contract with the navy in 1841,[63] and a year later the first navy contract

51. U.S. National Archives, RG45, E235, II, 210-11.
52. Ibid.
53. Ibid., RG74, Contracts, no. 2, December 1810 - June 1818, p. 207.
54. Ibid., RG45, E235, II, 289-90.
55. Ibid., RG45, E235, II, 285-87.
56. Ibid., RG45, E235, II, 287-88; also RG217.
57. Giles Cromwell, *The Virginia Manufactory of Arms* (Charlottesville, Virginia: University Press of Virginia, 1975), pp. 131-32.
58. Ibid., passim, pp. 131-37.
59. U.S. National Archives, RG217.
60. Ibid., RG45, E235, II, 293.
61. Ibid., RG45, E235, II, 305-6.
62. Ibid., RG45, E235, II, 342-32; also RG 217.
63. Ibid., RG217.

was signed with Joseph R. Anderson of the Tredegar Foundry in Richmond, Virginia.[64]

By the time of the Civil War, three foundries had captured the heavy ordnance market in the North: Fort Pitt (Knap and Totten), West Point Foundry Association (Parrott), and the South Boston Iron Works (Alger). The Tredegar (Anderson), the remaining foundry of the 'Big Four' prior to the Civil War, became the principal supplier of heavy ordnance to the Confederacy. But even by 1863, the entire production of all southern foundries combined did not exceed 16,000 tons a year.[65] The lack of sufficient foundry capacity contributed substantially to the defeat of the Confederacy.

64. Ibid.

65. Sanders and Gould, *History Cast in Metal*, pp. 414-15.

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The Frank C. Munson Institute of American Maritime Studies

By Benjamin W. Labaree

ON a steamy July evening in 1955, a small group gathered in the Aloha Meeting House on the grounds of the Mystic Seaport Museum for the opening session of the Frank C. Munson Memorial Institute of American Maritime History. Such a long title may have seemed a bit pretentious at the time, but in the years since then nearly five hundred men and women have studied maritime history in the museum's unique setting under the tutelage of some of the nation's leading authorities in the field. Through its faculty and students the Munson Institute has made a continuing contribution to our understanding of maritime activities and their significance to the development of the country.

Primary credit for the idea of the institute belongs to Edouard A. Stackpole, who came to Mystic in 1953 as curator from his native island of Nantucket, where he had been editor of the newspaper, director of the Nantucket Historical Society, and an established authority on American whaling. Within a few months after his arrival, Stackpole began to explore ways to use the museum's unusual collections in support of an educational program. At first he hoped to encourage college professors to bring their own classes of students to Mystic for specially conducted tours, but the inadequacy of this approach was soon apparent. Stackpole had the good sense to sound out faculty and administrative members at nearby institutions for ideas: Al Van Dusen at the University of Connecticut, Len Labaree at Yale, Burnham Dell, recently retired from Princeton, and Rosemary Park, president of Connecticut College. Other early advisers were Harold H. Kynett and Marion Dickerman, the latter even winning the approval of Yale's President Charles Seymour. Out of these discussions came the conclusion that the museum should offer a summer course, primarily for graduate students and teachers, and taught by a visiting faculty.

One of the people Stackpole was urged to meet was Robert G. Albion, Gardiner Professor of Oceanic History and Affairs at Harvard University. An exchange of correspondence in the spring of 1954, followed by a meeting in Cambridge, brought together two of the three people most responsible for the founding of the Munson Institute. Albion discouraged the suggestion of establishing a chair in maritime history at the museum, pointing out that a much stronger faculty could be attracted on a summer-time-only rather than a year-round basis. Six weeks of classes meeting three times a day, he suggested, was easily equivalent to a full-year course on campus, and Albion had no doubt that Harvard and other universities would grant graduate credit for such an undertaking. Somewhere along the line he intimated that he would be happy to teach at Mystic if he could earn as much as his Harvard summer-school salary. With that disclosure Stackpole knew he had the core of his faculty in hand and could turn next to the problem of finding the necessary financial support.

From the beginning the president of the Marine Historical Association (Mystic Seaport's formal name at that time), Philip R. Mallory, had taken a strong interest in Stackpole's plans, for they fitted in well with his own ideas of the museum's potential contributions. As plans took more definite shape, Mallory discussed the proposal with his sister, Cora Mallory Munson. In November 1954, Mrs. Munson became the third partner in the scheme when she agreed to provide $7,500 for each of five trial summers, and to make a bequest of $150,000 in her will. If all went well during the trial period, this money would become a restricted endowment fund for the program, as a memorial to her late husband, Frank C. Munson. He had been president of the Munson Steamship Lines and a prominent figure in American shipping between the two world wars. If, on the other hand, the trustees of the museum concluded that the program was a failure after five years, the income would go directly to the museum itself.

The board of trustees accepted the terms of Mrs. Munson's gift without hesitation. Throughout the winter and spring of 1954-1955 plans went forward at a

furious pace. Stackpole assumed the title of director and Albion coordinator of what soon became known as the Frank C. Munson Memorial Institute of American Maritime History. The two hammered out a syllabus and reading list and even considered the possibility of editing a textbook in maritime history for the program. Albion had already compiled a bibliography for his Harvard course based in part on his quarterly columns in the *American Neptune*. From these and other sources he began to compile long lists of books and other materials essential for the academic success of the program, but the museum had no funds for library acquisitions, and in fact hardly a library at all worthy of the name. But Stackpole sent off book orders with one hand while passing the hat among museum benefactors with the other. His friend Kynett was particularly helpful in this regard. Responsibility for classroom space, field trip arrangements, and student housing, among other matters, all landed on Stackpole's crowded desk as well, but somewhere he found the solutions to each problem as it came along.

Meanwhile, Bob Albion was busy recruiting a teaching staff from among his many friends in the maritime field. He persuaded Byron Fairchild, biographer of William Pepperrell, to join him as an associate especially for the colonial period, and Jack Kemble from Pomona College to assist with the more recent years and to cover the Pacific as well. Stackpole himself was signed on for a number of lectures, and Bob took responsibility for most of the rest. But Albion knew the value of including authorities from outside of strictly academic circles, and so he invited people like Marion Brewington from the Chesapeake, Charlie Copeland and Ernest Dodge from the Peabody, C. Owen Smith, editor of the *Maine Coast Fisherman*, and many others to lecture on their subjects of specialty.

On 21 June 1955, two weeks before the opening class, Mrs. Munson died. Fortunately for the institution she helped to found, however, its future had already been provided for in her will, and the program opened on schedule, with fourteen students from a wide range of academic and personal backgrounds on hand. The basic features as established in the summer of 1955 would remain in place for more than fifteen years: a six-credit course, primarily for graduate students, with numerous outside lecturers assisting the regulars, and full use of the museum's exhibits to supplement the classroom presentations. In 1957 the University of Connecticut agreed to offer credit for the courses through its Department of History, and for many years thereafter the two institutions had a close relationship.

A look at the first year's syllabus gives us a good idea of what Albion and Stackpole considered worth teaching as 'American Maritime History.' There were 'period' lectures such as 'The European Background,' 'England's Colonial System,' and the 'Nineteenth Century and the California Trade.' There were topical lectures like 'The Slave Trade,' 'Sealing,' 'Shipping and Science,' and 'Shipbuilding.' And interspersed throughout the course were lectures on more practical matters: 'Shiphandling,' 'Charts, Coast Pilots, Sailing Directions, and Lighthouses,' and 'The American Pilotage System,' for instance. Guests spoke on topics they knew best, often in a special evening series to which the public was invited. Some of the more interesting speakers that first year included Walter Hamschar, shipping editor of the *New York Herald-Tribune* on 'Covering the Waterfront and the Ships,' and Owen Smith on 'The New England Fisheries.' Irving Johnson stopped by to talk on his experiences under the heading 'Cruising the Seven Seas,' and Commander Lane Kendall, then at King's Point, spoke on the subject of 'Tramps, Liners, and Cargoes.' With sixty class-periods spread over five weeks and large doses of readings (Chapelle, Brewington, Morison, and of course Stackpole and Albion), the course covered a wide range of topics under its masthead. In addition, Fridays were reserved for field trips: New Bedford, New York, and Newport among the ports of call.

In 1956 two men, Albert Van Dusen, of the University of Connecticut, and Archibald R. Lewis, then at the University of Texas, began their long associations with the program, and a number of the previous year's guests won return engagements. But Albion was as ruthless in weeding out dull lecturers as he was in condemning inferior books in his bibliography. Choosing guest speakers, he often said, was a matter of steering a narrow course between 'the nitpickers and the b.s. artists.' On receiving a request for a job from a man whose stationery identified him as 'Master Mariner, B.S., B.A., LL.B., M.A., LL.D., Ph.D.,' Bob wondered whether the man would prefer to be called 'Captain' or 'Doctor,' and whether 'he is a normal human being and can lecture adequately.' Not surprisingly, we never found out the answer to either

question. In the next few years, however, Bob had great success in attracting speakers, luring Carl Cutler out of local retirement, Melvin Jackson from the Smithsonian, and C. Northcote Parkinson, at that time the Raffles Professor of History, from the University of Malaysia. His fellow Bowdoin graduate, Adm. Donald Macmillan, spoke on Arctic exploration just fifty years after his participation in Peary's 1909 discovery expedition, and Prof. Herbert Seward from Yale told of his experiences salvaging *Normandie* and investigating the loss of *Andrea Doria*. Nor did Bob confine his invitations to older, established figures in the field. Jim Baughman, Ted Sloan, and the present writer, among others, were all given a chance to try their wings.

A number of students in the course would in time become almost as well known as some of the speakers, and in fact several were later invited back as lecturers themselves. Any attempt to provide a comprehensive list here would not do justice to those omitted, but with that caveat consider the following: Frank Uhlig, long associated with the U.S. Naval Institute and now editor of the *Naval War College Review;* Melvin Jackson, late curator of the Smithsonian's maritime collections; William S. Wilkinson, director of the Mariner's Museum; Rodney S. Johnstone, co-designer of the J-24 and other successful racing boats; Bob Bryan, director of the Quebec-Labrador Foundation but probably better known for his 'Bert and I' roles; and Ethel Ritchie, whose major work we know as Fairburn's *Merchant Sail*. Other graduates now active in museum work include Alan Frazer at the New Jersey Historical Society, Norman Brouwer at South Street Seaport, Stephen Laise at Mariner's Museum, and Stuart Frank, director of the Kendall Whaling Museum in Sharon, Massachusetts. Professors John Hattendorf of the U.S. Naval War College and Lawrence Allin, of the University of Maine, also took the Munson program. Among librarians should be noted the late Hardin Craig, of Rice University; Gerry Morris, at the Blunt White Library at Mystic Seaport Museum; and Charlie Schultz, archivist at Texas A. & M.

The 1970s saw many changes in the Munson Institute, not the least of which was the replacement of 'Maritime History' by the broader term 'Maritime Studies' in the program's full title. Starting in 1972 the institute began offering additional courses. First, one in American maritime literature was originated by Prof. John Seelye of the University of Connecticut, and continued by Prof. Thomas Philbrick, of the University of Pittsburgh. Then in 1975 Roger Stein, from the State University of New York at Binghamton, offered a course in American maritime art. Meanwhile, the way in which students studied, especially in the summer, suggested that six-credit courses were no longer in vogue. The history lecture course was therefore reduced by half, and a seminar in American maritime studies was added. For two or three years in the mid-1970s, then, students could choose from four three-credit courses, and for several summers the total enrollments of these offerings greatly exceeded previous numbers. But there were losses as well. One after another of the 'giants' whom Bob Albion had attracted to the institute retired or passed away: Chappie, Fairchild, and Macmillan were no longer available, and Lane Kendall moved to the west coast. Cutting the number of classes by half also meant dropping some of the regular lecturers who were still on hand. Change came at the top as well. Ed Stackpole had left the museum in the mid-1960s, to return to Nantucket, and Bob Albion was slowing down a little more each year. In 1975 he relinquished the directorship and two years later, at the age of eighty, retired from teaching as well. Shortly thereafter, Jack Kemble began to cut down on his participation in the program, and in 1981 he, too, retired. The present writer, who had succeeded Bob Albion as director in 1975, was joined by Ted Sloan of Trinity as a regular colleague. From time to time Gaddis Smith from Yale and Bill Fowler from Northeastern have taken turns on the faculty as well.

The 1970s brought more than a changing of the guard and the addition of new courses. In the early years of the decade, when a number of colleges instituted special January programs, several professors brought groups of undergraduates to Mystic Seaport for a couple of weeks to study maritime history in situ, as it were. The enthusiasm shown by the students who accompanied me on two occasions was most encouraging, and they even suggested that we establish at the museum a semester-long program for undergraduates in American maritime studies. With the help of Waldo Johnston, then director, and Michael Sturges, head of the education department, we hammered out the basic idea of offering four regular college courses, all related to the sea, to students who resided at the museum. For financial reasons the idea was put on the back burner for several years until, in 1975, the Mallory Family Foundation made a very generous addition to the

Munson Institute's endowment, with the intention of encouraging an undergraduate program. At that point we took our plan off the shelf and went to work in earnest.

From the outset we agreed that to be worthwhile the program would have to be as academically rigorous as we could reasonably make it. To this end, therefore, we asked Williams College, where I was then teaching, to become the program's cosponsor, with particular responsibility for the maintenance of academic standards. Each course then went through the same process of adoption used for all new offerings taught at Williams and took its allotted place in the college catalogue. We also insisted that they be taught by persons of standing equal to that of members of the Williams faculty. For the program to be financially successful we needed at least sixteen and preferably twenty or so students for each semester. Obviously they would not all come from Williams itself, and so we turned to the Twelve College Exchange Group, whose members included Amherst, Bowdoin, Wellesley, and Wesleyan, among others. We then added another half-dozen similar institutions (Middlebury, Hamilton, and Tufts, for example), and thereby had a group of eighteen participating colleges from which to attract our students. While the program has always accepted applicants from other institutions, part of the idea from the beginning was to offer students at the smaller liberal arts colleges a special chance to take courses that their home campuses could not offer. Because a program's academic strength depends in large measure on the abilities of its students, we also knew that participants from these colleges would help maintain the high standards we had set.

To the basic concept of a four-course program we added several other features. Perhaps the most popular has been the ten-day research trip on board the schooner *Westward*. Fall students head out from Gloucester, across the Gulf of Maine and, winds permitting, spend several days on Georges Bank before returning to land at Woods Hole. In the spring, when the vessel is still in southern waters, the trip takes them into the Gulf of Mexico, often with a stop at the Dry Tortugas. Students carry out group research projects in oceanography and marine ecology on board and, as the vessel's crew, they get a good sense of what it is like to go off-shore under sail. Classroom discussions of the West Indies trade or Conrad's *Typhoon* thereafter take on fresh meaning. The program also encourages students to spend two afternoons each week developing a new maritime skill. Those who do not already know how to sail, for instance, take a boat-handling class; others enroll in celestial navigation, boatbuilding, or other maritime activities, not for credit but merely for the sense of accomplishment they get from learning new skills. One of the most challenging aspects of the program is that of the students making the most of their surroundings—the museum itself and its professional staff-members, the richly varied marine environment, and maritime activities at nearby seaports like Providence and New Bedford. To this end the science and marine policy courses have frequent field trips. By the end of the semester students have learned as much as possible about the sea through four different disciplines and a considerable amount of firsthand experience.

In September 1977 the Williams College-Mystic Seaport Program in American Maritime Studies opened with twenty-one students, chosen along with an equal number for the spring from among eighty-two applicants. Two full-time faculty members, with one of them also serving as director, a part-time visiting professor of literature, and a full-time assistant comprised the staff. Since then from sixty to ninety undergraduates have applied each year for the forty-two spaces available in the program. About one-third are science majors, another third come with history or American studies backgrounds, and the rest from a wide variety of fields. Some have crossed the Atlantic under sail, but most are neophytes to the sea. Women students have outnumbered men by about two to one, a ratio typical of other off-campus programs. Most are juniors although we have had a number of sophomores and a handful of seniors as well. One of the ideas is to give students an academic experience on which to build when they return to finish at their home colleges. Thus the Middlebury student who wrote her senior thesis on 'Shakespeare and the Sea' and the Trinity undergraduate who did a maritime history of Hartford illustrate the goals of the program as accurately as those who go on to graduate school in marine biology or find jobs with a ship broker in Greenwich, Connecticut, or an historical society in Gloucester. But like most other advocates of a liberal arts education, the Williams-Mystic faculty does not expect its students to make final career choices on the basis of their maritime studies. It is enough for us to know that they have gained an understanding of the sea that will enrich

their lives and inspire them to fight for the preservation of our marine environment.

It would be heartening to conclude this article with a ringing paean to the great advances made in the field of maritime history over the past thirty years. Indeed, research and writing in the field were never more active, and today the subject remains as important as ever. Some topics, such as exploration and discovery, have been virtually exhausted, however, and our knowledge of merchants, captains, and the vessels they sailed has nearly reached the saturation point. Yet much remains to be done in other areas of investigation: the influence of the sea on patterns of settlement; the relationship between commerce and agriculture; American trade, especially in commodities other than cotton and with regions other than England and China; living and working conditions for ordinary seamen, longshoremen, shipyard workers, and their families. And there are the more recent activities relating to marine recreation such as yachting, summer resorts, and the growth of shoreside communities in general. On a broader scale we should know how Americans have viewed the sea that has made them virtually an island people and especially how poets, writers, and artists express these attitudes.

But with the passing of Robert G. Albion, Samuel Eliot Morison, William H. Baker, Howard I. Chapelle, J. H. Parry, and Marion Brewington, to name but six giants in the field who have died in the last decade, one can only wonder where to look for the historians who will take up the work. Fewer graduate students pursue the subject these days, if only because it is not available to them, and the situation grows worse each year. Now it seems that Harvard University has decided not to appoint a successor to Parry, and thus the endowment given by the Gardiners in 1948 to establish a chair in oceanic history will apparently be put to other uses.

Meanwhile, enrollment in the Munson Institute has maintained a modest but healthy level—about twelve to fourteen individuals in one or both of the regular courses each summer. But only a handful of these persons in fact ends up teaching college and graduate students. Although the Munson Institute helps to keep maritime history alive as a legitimate academic subject, it is not a degree-granting institution and therefore can only supplement, not replace, the work of graduate schools. Yet herein lies an opportunity for directors of graduate studies to encourage interested students to take maritime history at the Munson Institute. Only by such cooperation, it seems to me, will future maritime historians have access to the kind of course-work, directed research, and specialized library facilities necessary to make a mark in this important field of history.

The work begun by Edouard A. Stackpole, Robert G. Albion, and Cora Mallory Munson thirty years ago is not yet finished, nor will it ever be. So long as our nation's past is studied we will need courses in maritime history. Those offered by the Munson Institute will continue to focus on the critical roles in the development of America played by the men and women who have worked on and lived by the sea.

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The Battle of the Atlantic:

1943, The Year of Decision

By David Syrett

THE Battle of the Atlantic was the decisive naval battle of World War II. Without victory by the Western Allies in the Battle of the Atlantic, it is probable that Britain would have been forced out of the war. German power would have been supreme throughout Western Europe. The Mediterranean would have become an Axis lake. There would have been no Allied aid to Russia. And it would have been impossible for the Western Allies to invade France in 1944 and defeat the German armies in Western Europe. The effects of a German defeat of the Western Allies in the Battle of the Atlantic are beyond calculation and comprehension.

There were two possible ways that the Western Allies could have been defeated in the Battle of the Atlantic. One was for the Germans to end by naval action the ability of the Allies to transport by ship men and materiel across the North Atlantic from North America to Great Britain and the Mediterranean. The other was to defeat the Allies by sinking so many merchant ships that the enemies of Germany would no longer be able to transport anything by sea. The Germans and their allies—using U-boats, surface raiders, mines, aircraft, and E-boats—employed both strategies in their attempt to win the Battle of the Atlantic. By the narrowest of margins, however, the Western Allies defeated the Germans in the Atlantic and thus were able to invade first the Mediterranean and later France to destroy by force of arms the German armies in Western Europe.

The Battle of the Atlantic was a battle which the Germans could have won. They lost because of superior Allied strategy, tactics, intelligence, technology, and material resources. In the harsh light of hindsight it is easy to see why the Germans lost the Battle of the Atlantic; however, during the battle itself nothing was clear to the men who manned Allied ships and aircraft, for the outlines of the conflict were obscured by endless images of sinking ships, exploding depth charges, and ever so rarely a U-boat being blasted to the surface and sunk by gunfire. To the Germans who manned U-boats, aircraft, surface raiders, and E-boats, the Battle of the Atlantic was equally cloudy; for although they sank thousands of Allied merchant ships, their own losses of ships, aircraft, and U-boats steadily rose for reasons that even the German High Command never fully understood.

To analyze and understand the Battle of the Atlantic, a number of preconceived notions and myths about the nature of naval warfare held by both civilians and members of the armed forces must be cast aside. Vague doctrinal phrases such as 'command of the sea' or 'protecting trade routes' must be seen to be meaningless. The Battle of the Atlantic was fought over merchant ships. The Allies wanted to be able to sail merchant shipping free from enemy attack, and the Germans wanted to deprive the Allies of merchant ships by sinking them. The protection or destruction of merchant ships is what the Battle of the Atlantic was all about, not a struggle for control of the vast wastes of the world's oceans.[1]

Another notion that has to be thrown over the side if one is to understand fully the Battle of the Atlantic is 'the mystique of the offensive' in warfare. Navy officers, as all military men, are taught from the first day they enter the service that it is their highest duty to take offensive action against the enemy. Unfortunately, the many forms an offensive action can take are often never adequately defined or completely understood. As a result, if an action appears to be offensive in nature then it is assumed to be hurting the enemy. This was simply not the case for the Allies in the Battle of the Atlantic. The idea that a group of new high-speed fleet destroyers conducting search and destroy operations or offensive patrols against U-boats is acting offensively and therefore hurting the enemy is not borne out by the facts. An escort group made up of two rusty World War I destroyers and several overworked corvettes, while appearing to be nothing more than a group of floating, armed baby-sitters for a number of slow merchant ships, in fact could hurt the enemy far more than any offensive patrol.

1. Cf. Roland Alfred Bowling, *The Negative Influence of Mahan on the Protection of Shipping in War Time: The Convoy Controversy in the Twentieth Century* (unpublished University of Maine Ph.D. thesis, 1980).

Statistics are the only tool that can enable the historian to cut through preconceived notions and deal with the huge mass of information about the Battle of the Atlantic. The Germans lost to all causes 782 U-boats during World War II. The total number of U-boats sunk by air and surface escorts in convoy or convoy-related battles was 336 or 42.9 percent. All other causes amount to 446 or 57.1 percent of all U-boats lost during the conflict. The results of so-called offensive operations against German U-boats undertaken by the Allies in World War II when compared to the losses inflicted on German U-boats by convoy escorts are almost insignificant. For example, offensive anti-U-boat patrols made by aircraft in the Bay of Biscay resulted in sinking 43 U-boats, which is about 5.59 percent of all U-boats lost. Offensive patrols by aircraft in the Northern Transit Area resulted in the sinking of only 21 U-boats, about 2.68 percent of the total lost by the Germans. Allied submarines sank the same number of U-boats as aircraft patrolling the Northern Transit Area while mines accounted for 30 U-boats, or about 3.83 percent. Allied air and surface patrols in the Straits of Gibraltar resulted in the sinking of only 14 U-boats, a mere 1.79 percent. Worldwide in regions other than the Straits of Gibraltar, the Bay of Biscay, and the Northern Transit Area, aircraft conducting offensive patrols against German U-boats sank only 35, or roughly 4.47 percent. Offensive patrols by warships accounted for 46 U-boats, near 5.88 percent.[2] There can be no question that convoy escorts, while protecting merchant shipping from enemy attack, destroyed many more enemy attackers during the course of the Battle of the Atlantic than all the Allied ships and aircraft deployed in so-called offensive missions or patrols.

The most effective German weapon against Allied merchant shipping during the Battle of the Atlantic was the U-boat. During World War II, 5,150 Allied merchant ships amounting to 21,570,720 tons were lost. Of these, 2,828, or 54.9 percent of the total number of ships lost, were sunk by U-boats. The total tonnage lost to U-boats was 14,687,231 tons, or 68.1 percent of the shipping tonnage lost during the war. All other causes seem minor by comparison. Aircraft sank 820 Allied merchant ships, or 15.9 percent of the total. Mines were responsible for the loss of 534 merchant ships, or 10.3 percent; warship raiders for 104 merchant ships, or 2.02 percent; merchant raiders for 133 ships, or 2.6 percent; and 99 merchant ships, or 2.0 percent, were lost to E-boats. Maritime casualties and unknown causes resulted in the loss of 632 merchant ships, or 12.3 percent.

The regions where German U-boat operations were the most intense during World War II were those in which the largest number of Allied merchant ships were lost. During the years 1939-1945, the Allies lost in the North Atlantic, United Kingdom coastal waters, and the Arctic 3,663 merchant ships with a total tonnage of 15,668,331 tons. This represents 60.8 percent of the total number of ships lost and 72.6 percent of the total tonnage lost. In the South Atlantic during the same period, the Allies lost only 174 ships, or 3.4 percent. In the Mediterranean 413 ships were lost, accounting for 8.0 percent. Allied losses in the Indian Ocean were 385 merchant ships, or 7.5 percent; and in the Pacific 515 merchant ships, or 10.0 percent were lost. In 1942 the Allies lost the most merchant ships in a given year when 1,664 merchant vessels with a total tonnage of 7,790,697 tons were sunk by all causes worldwide. Of these, U-boats sank 1,160 merchant ships with a tonnage of 6,266,215 tons. The vast majority of these ships, amounting to 1,096 merchantmen with a total of 5,688,107 tons, were lost in the North Atlantic, United Kingdom coastal waters, and the Arctic. In 1943, however, the number of Allied merchant ships lost to all causes dropped dramatically. In that year, 597 Allied merchant ships with a tonnage of 3,220,137 tons were lost to all causes worldwide, while U-boats sank only 463 ships with a total tonnage of 2,586,905 tons. And in the North Atlantic, United Kingdom coastal waters, and the Arctic only 309 merchant ships were lost.[3]

When the loss rates of German U-boats are compared with those of Allied merchant ships an interesting pattern appears. During the years 1939-1945, the Germans lost 782 U-boats to all causes. In 1939 only 9 U-boats were lost, in 1940, 22 U-boats were sunk, in 1941, 35 U-boats were sunk, and in 1942, 87 U-boats were sunk. But in 1943, 237 U-boats were sunk, in 1944, 239 U-boats were lost, and before the war ended in 1945 a further 153 U-boats were destroyed.[4] Put in the most simple terms, the Allies won the Battle of the Atlantic and the Germans lost it because in 1943 the

2. Admiralty Historical Section, *The Defeat of the Enemy Attack on Shipping, 1939-1945* (London, 1957), 1A, 251-80.

3. S. W. Roskill, *The War at Sea, 1939-1945* (London, 1961), II, part II, 479.

4. *The Defeat of the Enemy Attack . . .*, 1A, 245.

German U-boats' ability to sink Allied merchant shipping declined sharply while the number of U-boats sunk by the Allies increased greatly. The obvious question is: why did the whole course of the Battle of the Atlantic change in favor of the Allies in 1943?

When World War II began in 1939, neither the Allies nor the Germans were prepared to fight the Battle of the Atlantic. The development of the German navy had been governed by the *Z Plan*, which called for the construction of a balanced naval force capable of confronting Britain in 1948. On 3 September 1939, the Germans had only 57 U-boats in commission, and Hitler did not give U-boat construction a very high priority. Only 18 U-boats were built in 1939, and in 1940, 50 more were constructed. It was not until 1941 that German U-boat construction reached three figures per year. Not only did Germany begin the war with an unbalanced and weak navy, but German maritime capabilities were further weakened by the inability or unwillingness of the Luftwaffe to carry out operations in support of the German navy.[5] Thus, in the first years of World War II the German navy and its U-boat service were in no condition to contest control of the North Atlantic with the British Commonwealth.

At the beginning of the war, the Royal Navy was much stronger than the German navy in every respect; but nevertheless the Royal Navy was unprepared to deal with attacks on merchant shipping by U-boats. Part of the problem was that with the 'ten-year rule'[6] in effect during most of the interwar years, the Royal Navy put most of its money and effort into building and maintaining capital ships and the other types of ships required to form a balanced battle fleet, and problems of trade protection were not given much thought or many resources. Moreover, because of their small numbers, German U-boats were not seen as a threat until almost the beginning of the war. Also, it was thought that British development of asdic, later called sonar, gave the Royal Navy the means to defeat U-boats. Another problem was that relations between the Royal Navy and the Royal Air Force were at best strained. The maritime arm of the Royal Air Force was its Coastal Command, and Coastal Command was not equipped with the right types of aircraft, no air-borne depth charges existed, nor were the aircrews correctly trained for an anti-U-boat campaign.

The British began the Battle of the Atlantic with some out-of-date aircraft and a few sloops and some World War I destroyers that could be employed as escorts. At the beginning of the war, regular convoys were instituted for shipping on Britain's east coast, but for the most part the British intended to combat U-boats by offensive patrolling with aircraft and warships along the routes in the western approaches used by merchant ships proceeding to and from Britain. British seaborne trade was to be further protected by 'anti-submarine hunting units.' It was soon evident that none of these measures was effective, for in the first four months of the war a very small number of U-boats sank 114 merchant ships with a total tonnage of 421,156 tons. Only 12 of these ships were in convoy, 5 others were stragglers from convoys, and the remaining 97 ships were sailing independently without naval escort when they were attacked and sunk.[7] The British apparently had not learned the lesson of World War I that the way to defeat U-boat attacks on shipping is with an extensive system of convoys.

The histories of previous maritime conflicts clearly show that the best way to protect merchant shipping from attack with the least expenditure of effort is to employ a strategy based upon a system of convoys. This is the lesson of the great maritime wars of the seventeenth and eighteenth centuries as well as of World War I. Winston Churchill put forward the argument after World War I that losses to German U-boats would have been less if British shipping, instead of sailing singly, had sailed in convoys even if they were not escorted by warships.[8] The tactical and strategic concept of convoy is devilishly simple. If, for example, 80 merchant ships are sailing independently, then an enemy has 80 different points to attack while the defender has 80 different points to defend. If, however, these 80 merchant ships are grouped together into a convoy, it is much more difficult for an enemy to locate and intercept them than if the 80 ships were scattered across the ocean at random. Further, a convoy gives the defender only one place to defend—the convoy itself—and the attacker only one place to attack. An enemy attacking a convoy is open to counterattack by the convoy's escort; therefore, to mount a successful attack on the convoy the enemy must first

5. Friedrich Ruge, *Der Seekrieg: The German Navy's Story, 1939-1944* (Annapolis, Md., 1957), pp. 31-49.

6. The 'Ten Year Rule' required that each year all defense planning, construction, and spending be based upon the assumption that Britain would not have to fight a major war for the next ten years.

7. Roskill, *op. cit.*, I, 1-110.

8. Winston S. Churchill, *The World Crisis* (London, 1929), IV, 347.

find the convoy and then either overpower or elude the convoy's escort. Locating and then attacking a convoy in the face of an armed escort is a much more difficult problem than attacking a number of merchant ships sailing independently. Also, if the convoy's escort deters an enemy from attacking merchant ships under escort, then the ultimate objective of a convoy has been achieved, which is the ability to pass merchant shipping across bodies of water free from attack and without fighting battles.

Another advantage of convoys is that historically as well as mathematically it is a fact that the greater the number of ships placed into a single convoy, the smaller the number of escorts required per merchant ship to protect the convoy. If, for example, 14 escorts are required to screen a convoy of 28 merchant ships from U-boat attack, and the convoy is increased to 112 merchant ships, then using the same screening pattern as for the 28-ship convoy, only 21 escorts will be required for the much larger convoy. It is very strongly argued in many quarters that convoys not only are the best way to protect merchant ships from attack but also the only way.[9]

At the beginning of World War II many British officers and officials, including Winston Churchill, who was then First Lord of the Admiralty, knew from the experience of World War I that convoys were the most effective means of protecting merchant shipping. Such knowledge by itself is not much help, however, if there are not enough ships and aircraft available to set up an all-embracing system of convoys. It was not until 27 May 1941 that the first convoy was provided with an anti-U-boat escort for the entire length of the voyage from North America to Britain. In July of 1940, for example, merchant ships sailing from Britain to North America were escorted in convoys only as far as seventeen degrees west, at which point they sailed independently to North American ports. The failure to provide anti-U-boat escorts for the entire Atlantic crossing cost the British many merchant ships, but the simple fact was that at the beginning of the war the British did not have the number of ships required to provide escorts for convoys. Further, naval operations in Norway, Italy entering the war, and the threat of invasion in 1940 cut deeply into the resources of the Royal Navy. It was not until the summer of 1941 that the Royal Navy and the Royal Canadian Navy obtained from new construction and the United States a sufficient number of escorts to begin even a halfway-effective system of convoys in the Atlantic.[10]

In the years just before the war, the Admiralty saw the need to increase the number of ships in the Royal Navy that could be used as convoy escorts. In 1937 the Admiralty designed to be built to naval specifications an ocean escort sloop class known as 'Black Swan.' The first ship of this class was laid down on 20 June 1938. The 'Black Swan' sloops were heavily armed, capable of 20 knots, and were very good convoy escorts; but owing to their cost and the length of time required to build them, only 37 of them were built. The only other escort vessel, besides fleet destroyers, built to naval specifications by the British were 'Hunt' class destroyers. Designed in 1938, the first 'Hunt' class destroyer was laid down on 8 June 1939, and 86 ships of this class were constructed during the course of the war. While 'Hunt' class destroyers were good escorts, it was seen even before the war began in September 1939 that escort vessels would be needed in such large numbers that there was neither the time nor money to build the required number of ships to naval specifications.

The majority of escorts designed and built by the British and Canadians were constructed in civilian yards and followed 'classification society rules and merchant shipbuilding practices.'[11] This policy was followed to save time and money and to make the maximum use of shipbuilding capacity in the United Kingdom and Canada. The first and perhaps the most well known of these war-built escorts were the 'Flower' class corvettes. These ships were constructed to serve as escorts in coastal waters and were a modified version of the whale catcher *Southern Pride*, which was built by Smith's Dock Company Ltd. of South Bank on Tees. In the summer of 1939, the Royal Navy ordered 60 'Flower' class corvettes, and after the beginning of the war in that same year the Canadian government ordered built in Canadian yards 64 'Flower' class corvettes for the Royal Canadian Navy. By the end of the war, 214 'Flower' class corvettes had been constructed in Britain and Canada at a cost of

9. The world's leading authority on convoys is Lt. Comdr. D. W. Waters, RN. He has written extensively and authoritatively on every aspect of convoys. The bulk of Waters's writings on the subject are in the Waters Papers at the National Maritime Museum, Greenwich, London, England. See especially, National Maritime Museum, WTS/31/1, 'Notes on the Convoy System of Naval Warfare: Thirteenth to Twentieth Centuries.'

10. Roskill, *op. cit.*, I, 451-54.

11. Standards set forth by Lloyd's for classifying ships for the purposes of insurance.

Germany must go to war with the United States in 'order to achieve successes during this phase of relative weakness of the USA.' The German navy viewed the enacting of the Lend Lease Act as tantamount to 'entry of the United States into the War.' But Hitler repeatedly ordered the German navy not to attack American shipping and to respect all the security zones proclaimed by Roosevelt. Hitler did not want a war with America in 1940 or 1941; his plan was to conquer the Russians first. After defeating Russia, Hitler then intended to turn on his enemies in the West and crush Britain and the United States. But Hitler was not in a position to call the shots in the Atlantic; and on 1 September 1941, Roosevelt began an undeclared naval war against Germany when the U.S. Navy was ordered to escort merchant ships of any nationality, in effect Allied vessels, across the Atlantic.[18]

President Roosevelt's undeclared naval war in the Atlantic was of great assistance to the British. The U.S. Navy took over responsibility for much of the mid-ocean escort duty, which released a number of British and Canadian escort vessels for employment elsewhere. The British would escort an outward-bound convoy from Britain to North America to a point south of Iceland known as the Mid-Ocean Meeting Point. At this place American warships would relieve the British escorts, and the U.S. Navy would escort the convoy to North American waters. Convoys coming from North America would be escorted to the Mid-Ocean Meeting Point, where American warships would be relieved by British escorts of the Western Approaches Command to protect the convoy on the last leg of the voyage to the British Isles.

Roosevelt, Churchill, and Hitler knew that if the U.S. Navy escorted British and other Allied merchant ships in the North Atlantic there were going to be incidents, even fighting, between the U.S. Navy and German naval forces. The orders for U.S. Navy ships to escort British and Allied merchant ships in the North Atlantic was one more step taken by Roosevelt to provoke Hitler while at the same time aiding Britain. Even before the U.S. Navy began escort duty in the North Atlantic, there had been a number of clashes at sea between Americans and Germans. On 19 April 1941, in Icelandic waters USS *Niblack* thought she was being attacked by a U-boat and counterattacked with depth charges. On 21 May 1941, U-69 sank the American merchant ship SS *Robin Moor* in the South Atlantic. And on 10 June 1941, U-203 attempted to attack USS *Texas* between Greenland and Newfoundland.[19] But with United States warships escorting Allied merchantmen, the naval incidents between American and German warships were going to be considerably more serious than those that had occurred before the American undeclared naval war in the Atlantic. The first major incident was the attempt of the U-652 to torpedo the USS *Greer* on 4 September 1941. Roosevelt saw the attack on the USS *Greer* as an act of 'piracy' and declared, 'From now on, if German and Italian vessels of war enter waters the protection of which is necessary for American defense, they do so at their own risk.'[20] But Roosevelt's 'shoot on sight' warning did not stop the clashes between American and German ships of war. At 2 A.M. on 17 October 1941, the U-568 torpedoed and heavily damaged the USS *Kearny,* which was escorting convoy SC 48. Fourteen days later, the U-552 torpedoed and sank the USS *Reuben Jones,* which was escorting convoy HX 156. The USS *Reuben Jones* was the first American warship sunk by German forces in World War II. In the South Atlantic the USS *Omaha* and *Somers* intercepted and seized the German blockade runner *Odenwald* and brought the German ship into San Juan, Puerto Rico, as a prize on 11 November 1941 under the incredible pretense that the ship was engaged in the slave trade.[21]

Day after day in the autumn and winter of 1941, units of the U.S. Navy escorted Allied merchant ships across the North Atlantic. The weather was extremely harsh, there were never enough escorts to do the job properly, and there was always the danger of being attacked and sunk by a U-boat.[22] Roosevelt's undeclared war in the Atlantic during 1941 gave the Germans two choices: either permit the United States to aid Britain, or attack American warships escorting convoys in the Atlantic to such an extent that there would be war between the United States and Germany. Until the Japanese attack on Pearl Harbor, however,

18. For all the twists and turns of German and American policies in the months before American entry into World War II, see Holger H. Herwig, *Politics of Frustration: The United States in German Naval Planning 1889-1941* (Boston, 1976), pp. 175-261. The quote is from p. 221.

19. S. E. Morison, *History of United States Naval Operations in World War II* (Boston, 1975), I, 57, 63, 73.

20. Ibid., I, 79-81.

21. Ibid., I, 84, 92-94.

22. The best account of the undeclared war in the Atlantic is Patrick Abbazia, *Mr. Roosevelt's Navy: The Private War of the U.S. Atlantic Fleet, 1939-1942* (Annapolis, Md., 1975).

Hitler refused to permit German U-boats to make a head-on assault on American ships in the Atlantic.

On 7 December 1941, the Japanese attacked Pearl Harbor. Four days later Germany declared war on the United States of America.[23] Admiral Doenitz reacted to the declaration of war against the United States with great speed. On 13 January 1942, five U-boats began operations off the east coast of the United States. The Americans were totally unprepared for U-boat attacks in United States coastal waters. It was a second 'happy time' for the U-boats. Navigation aids, such as lighthouses, were still turned on at night, American coastal cities were ablaze with lights, and even though Germany had been at war with the United States for over a month, shipping in American coastal waters was still sailing as if it were peacetime. Huge amounts of shipping were sunk by a mere handful of U-boats. From the middle of January to April 1942, at the cost of one U-boat, the Germans in American coastal waters sank 198 ships amounting to 1,150,675 tons; and during May and June, U-boats in the Caribbean sank an additional 148 ships amounting to 750,009 tons. U-boat operations were greatly assisted at this time by the introduction of three U-boat tankers or 'milch cows,'[24] which enabled U-boats to be refueled and resupplied with torpedoes at sea. This greatly increased the length of U-boat operational patrols.

The U-boat assault on the American east and gulf coasts and the Caribbean cost the Allies thousands of tons of merchant shipping and was considered by some Americans to be a second or east coast Pearl Harbor. However, by the end of June the U-boats' 'happy time' was over, for by then the U.S. Navy had introduced what was known as the 'interlocking convoy system,' which enabled merchant ships to sail in convoy between various ports in American coastal waters and the Caribbean. Doenitz noted that as 'the convoy system was gradually introduced . . . it became obvious that in the near future the main effort of the U-boat war would have to be switched back to wolf-pack attacks on convoys.' [25]

From the end of the U-boat offensive in American coastal waters and the Caribbean in June of 1942 to the summer of 1943, the North Atlantic convoys were subjected to heavy attacks by U-boats using wolf-pack tactics. However, it was during this period that the Germans were increasingly confronted with and confounded by advances in Allied intelligence. German naval intelligence was weak and in a state of confusion. The Germans, for instance, felt assured that they had a number of good agents in the United Kingdom. As the world learned in 1972, however, these agents were all double agents working for the British.[26] Also, intelligence on the location of Allied convoys was hampered by the fact that in 1940 the Luftwaffe would provide in support of U-Boat Command only one or two reconnaissance flights a day by FW-200's over waters to the west of Ireland.[27] One factor in the U-boats' favor in this otherwise hazy intelligence picture was that a unit of German naval intelligence—*B-Dienst*—had been reading British naval codes for years; and in the first years of the war communications intelligence was one of the best sources of information available to U-Boat Command. Owing to lack of cooperation from the Luftwaffe and other failures, about 60 percent of all German intelligence in western Europe came from communications intelligence.[28] After the war it was estimated that information from code breaking enabled the U-boats to sink an additional 60 to 100 Allied merchant ships.[29] But even in the field of communications intelligence things were not very well organized, for the army and navy units running radio direction-finding intercept stations in France refused to exchange information with each other about Allied radio transmissions until the end of 1943.[30] As the war went on, German naval intelligence in western Europe grew weaker and weaker because Allied signal security became progressively stronger, and in 1943 *B-Dienst* found it could no longer read British naval codes.

From the beginning of the war, the German U-boat service was the subject of an intense intelligence attack by the Submarine Tracking Room of the Royal Navy's Operational Intelligence Centre and also by

23. For an account of the reasons for Hitler's declaration of war against the United States, see Herwig, *op. cit.*, pp. 235-38.

24. U-116, U-459, U-460.

25. Doenitz, *op. cit.*, pp. 196-224. The quote is from pp. 221-22. For an account of American defensive measures, see Morison, *op. cit.*, I, 125-57, 247-89.

26. J. S. Masterman, *The Double-Cross System* (New Haven, Conn., 1972).

27. Ruge, *op. cit.*, pp. 155-62.

28. David Kahn, *Hitler's Spies: German Military Intelligence in World War II* (New York, 1978), pp. 213-21.

29. Carl E. Behrens, 'Effects on U-Boat Performance of Intelligence from Decryption of Allied Communications' (U.S. Department of the Navy, 1954).

30. U.S. Army, Adjutant General's Office, German Military Documents Section, *German Operational Intelligence* (Washington, D.C., 1946), pp. 20, 132.

the Government Code and Cipher School at Bletchley Park. Under the direction of Roger Winn, a barrister in civilian life, the Submarine Tracking Room using sighting and sinking reports, D/F and HF/DF fixes,[31] information obtained from POW's, and analysis of U-boat radio transmissions, slowly built a picture of German U-boat operations and standard operating procedures. It was found, for example, that a single U-boat could be traced, not by reading its radio transmissions, but rather by the way in which its radio operator used a telegraph key. It also was discovered that the meaning of certain radio transmissions could be deduced from such factors as the location of a U-boat or the length of the transmission. Ever so slowly and painstakingly, Winn's Submarine Tracking Room, using a clue here and a bit of information there, relentlessly constructed an intelligence picture of the workings of the German U-boat service. By 1941 the Royal Navy's Submarine Tracking Room, although not yet able to read U-boats' coded radio transmissions, knew more about the workings of the German U-boat service than *B-Dienst* knew about the workings of the Royal Navy.[32]

In 1941 the British code-breakers at Bletchley Park broke the German naval codes. This achievement required a great deal of hard work, skill, and luck because although the German navy used the same basic code machine—the *Enigma*—as did the German air force and army, the naval version had been modified to make it more secure than those of other branches of the German armed forces. The information necessary to read German naval codes came to the British code-breakers in bits and pieces. In February of 1940 three wheels of a naval *Enigma* code machine were obtained from the crew members of U-33. Several months later, in April 1940, cipher materials recovered from the German patrol boat VP2623 enabled the British to read six days of naval transmissions. On 4 March 1941, during the raid on the Lofoten Islands, additional cipher materials were found on the captured German trawler *Krebs*. But this still was not enough information for the British code-breakers, and in an effort to obtain more information on German naval codes expeditions were mounted to capture two German weather ships. On 7 May 1941, the weather ship *München* was captured, and on 28 June the weather ship *Lauenburg* was taken. Both of these ships yielded additional information about German codes; however, the biggest haul of cipher materials was made two days after the capture of *München*. On 9 May U-110 was forced to the surface by depth charges in a nearly sinking condition. U-110's crew abandoned the vessel without destroying code and cipher materials, thinking it was sinking fast. Unknown to the crew of the German U-boat, a boarding party from HMS *Bulldog* managed to get on board U-110 and remove all the code and cipher materials including a naval *Enigma* code machine. U-110 later sank while being towed to Iceland.

The information obtained from the two German weather ships and U-110 enabled the code-breakers at Bletchley Park to mount a successful attack in 1941 on the German naval codes.[33] But on 1 February 1942 the Germans added a fourth wheel to the naval *Enigma* code machine used for communications between U-boats at sea and U-Boat Command. Fortunately for the Allies the Germans did not change the codes used by U-boats in European coastal waters, which enabled the Allies to continue to have knowledge of U-boat activities in the Baltic, the North Sea, and the Bay of Biscay. However, it was not until December 1942 that the Allies broke the new German naval code based on the four-wheel naval *Enigma* code machine. After the war the nine-month period when the Allies could not read the four-wheel naval *Enigma* code was considered to be 'the most serious cryptanalytic failure' in the whole Allied attack on German naval codes. But after breaking the four-wheel *Enigma* code the Allies continued to read with little difficulty radio transmissions to and from U-boats at sea until the end of the war.[34]

Several months after the boarding of U-110 a Hudson aircraft of RAF Coastal Command received the surrender of U-570 some eighty miles south of Iceland. U-570 had the misfortune to come to the surface right under the British aircraft, which immediately attacked the U-boat with depth charges and cannon fire. After the first attack by the aircraft, the U-boat surrendered because the damage it had received made it impossible to submerge. Aircraft from RAF Coastal Command circled over the U-boat until an armed trawler arrived to take U-570 into a British port. With the capture of U-570, the British learned a number of

31. Radio direction finding and high frequency radio direction finding.
32. Patrick Beesley, *Very Special Intelligence* (London, 1977).
33. F. H. Hinsley, *British Intelligence in the Second World War* (London, 1979), I, 163, 336-39.
34. Ibid., II, 178-79, 223, 548, 551-52, 747-52.

important facts about a German-type VIIC U-boat, including how deep it could dive and the size of the U-boat's turning circle, as well as the volume and character of the vessel's machinery noises.[35] When the U.S. Navy's OP-20-G discovered in May of 1943 that the Germans were reading the Combined Naval Cipher, the Allied victory on the intelligence side of the Battle of the Atlantic was complete.[36]

From 1941 until the end of the war, the German U-boat service was steadily hurt by Allied advances in technology, many of which were impossible for the Germans to counter. In January of 1942, for example, Allied escorts began to be armed with hedgehog mortars. One of the main disadvantages of a standard depth-charge attack was that the explosions of depth charges caused the escort to lose sonar contact with the U-boat it was attacking. But the hedgehog, mounted on the foredeck of an escort, was a forward-firing weapon that threw a number of mortar-like bombs in front of the attacking escort. These bombs were fired in an arc of 215 yards, landed in a 130-foot circle, sank in the water at 23 feet per second, and exploded on contact with a U-boat. The advantage that the hedgehog and a similar type of weapon known as a squid had over depth charges was that an escort could maintain sonar contact with a U-boat throughout an attack. Some 50 U-boats were sunk by hedgehog attacks before the war ended; and the squid, which came into service in 1944, sank a further 18 U-boats.[37]

The development of a number of electronic devices enabled the Allies first to blunt and then to overcome German wolf-pack tactics. At the beginning of 1941, Allied escorts were being fitted as fast as possible with radar sets capable of locating surfaced U-boats. As more and more Allied escorts were equipped with radar, night surface attacks on convoys by U-boats became increasingly difficult to the point of impossibility.[38] As early as the night of 17 March 1941, the Germans were given a lesson in what was to come when the U-100, after being forced to the surface by a depth charge attack by HMS *Walker*, attempted to escape on the surface under cover of darkness. The U-100 was picked up by radar mounted on HMS *Vanco*, which then rammed and sank the U-boat.[39]

In 1941 the Allies began to mount high-frequency direction-finding (HF/DF) equipment on escort vessels, giving them the ability to take bearings on the ground waves of a U-boat radio transmission if the U-boat was within twenty miles of the escort. HF/DF aerials were generally a birdcage type mounted on the top of a pole mast on the after end of an escort's superstructure.[40] Even though German agents in Spain took hundreds of photographs of Allied warships entering Gibraltar, the Germans never did figure out what the birdcage aerials were used for. An Allied escort equipped with HF/DF was a deadly weapon when used against a wolf pack. Wolf-pack tactics require a large number of radio transmissions from U-boats operating against a convoy. U-402, for instance, while attacking convoy SC 118, made in a period of four days forty-one different radio transmissions which were intercepted by the Allies. It took only three radio transmissions within an hour period from U-187, also attacking SC 118, for the convoy's escort to get a bearing with HF/DF on the German vessel and for two destroyers to run down the bearing, find the U-boat, and then sink U-187.[41] After the war, the failure of U-Boat Command to know about HF/DF and to understand its importance was considered by the Germans to be one of the great mistakes of the Battle of the Atlantic.[42]

In 1941 Allied escorts also began to be equipped with high-frequency radio telephones, which permitted an escort group commander to communicate with the ships under his command and enabled an

35. Anthony Preston, *U-Boats* (London, 1970), pp. 123-25. The boarding of U-110 was not made public until 1959. S. W. Roskill, *The Secret Capture* (London, 1959). The capture of an *Enigma* machine was not known to the public until the 1970s.

36. Operational Archives, Naval Historical Center, Washington, D.C., 'Allied Communications Intelligence and the Battle of the Atlantic,' II, chap. 2, sec. 6; chap. 4, sec. 6. Hereafter this document will be cited as ACI.

37. Brian Johnson, *The Secret War* (London, 1978), pp. 202-3.

38. Norman Friedman, *Naval Radar* (Annapolis, Md., 1981), pp. 81-93, 145-52.

39. Preston, *op. cit.*, p. 113.

40. Friedman, *op. cit.*, pp. 127-28.

41. Public Record Office, ADM/233/16, pp. 23, 41.

42. Jürgen Rohwer and Eberhard Jackel, eds., *Die Funkaufklarung und ihre Rolle im Weltkrieg* (Stuttgart, 1979), pp. 130-32. HF/DF, like radar, was a spin-off from research into the nature of the ionosphere by means of equipment using cathode ray tubes. HF/DF was much superior to standard radio direction-finding instruments for fixing the location of a radio transmission because it could do it at a great range and with greater speed. HF/DF sets mounted on a ship displayed on a cathode ray tube a very accurate bearing on any radio transmission picked up. The Germans, knowing that the Allies would use standard radio direction finders to attempt to locate U-boats, used a special series of codes that could be transmitted in less than thirty seconds. It is almost impossible to get a bearing on a transmission of this sort by means of a radio direction finder. But a ship-borne HF/DF set could get a very good bearing on these short transmissions and a good HF/DF operator could tell if the transmission was made near a convoy. Johnson, *op. cit.*, pp. 210-12.

Allied escort group to work as a team.[43] U-boats employing wolf-pack tactics, on the other hand, attacked convoys not as a team controlled by a commander on the spot, but rather as individual units under loose control from U-Boat Command hundreds of miles from the battle. The Allies saw the advantages of escorts working together to beat back a U-boat attack on a convoy, and each escort was assigned to a group and the ships of an escort group were trained and kept together to work as a unit under the direction of the escort group commander.[44]

At the beginning of the war Doenitz stated, 'The U-boat has no more to fear from aircraft than a mole from a cow.' The German admiral was to be proven totally wrong; during World War II, 312 Axis U-boats, of which 289 were German, were sunk by aircraft.[45] RAF Coastal Command began the war with an anti-submarine bomb that did not work, but by the end of 1939 British aircraft were armed with modified 250-pound naval depth charges for attacking U-boats. Numerous attacks were carried out by Allied aircraft during daylight hours against U-boats on the surface and often the mere sighting of an aircraft would force a U-boat to submerge. During World War I and World War II and even today the simple presence of an aircraft has an inhibiting effect on U-boat operations.[46]

Starting in the autumn of 1939, the British began developing air to surface vessel radar (ASV), and in 1940 started fitting ASV sets, which operated on a wave length of 1.7 meters, in aircraft thereby enabling them to locate U-boats on the surface at night or in bad weather. The problem was, however, that although an aircraft could locate a U-boat at night on the surface, it could not successfully attack the vessel because the 1.7-meter ASV set lost the target once the range was narrowed down to a mile or less. This problem was overcome with the invention of the Leigh Light. Radar on an aircraft would pick up a U-boat on the surface at night. The aircraft then would be put into a slow dive towards the U-boat on a bearing given by the radar. At the same time the Leigh Light, which was mounted like a gun in a turret, would also be tracking the U-boat from bearings supplied by ASV. At 250 feet above the water the aircraft, still heading for the U-boat, would pull out of the dive. When the ASV set lost the U-boat because of 'sea clutter,' the Leigh Light automatically would go on, the U-boat would be illuminated with a blinding 22-million candlepower, and several seconds later the aircraft would attack the U-boat with depth charges and gunfire from a height of about 50 feet. Surprise was total, for the first indication a U-boat had that it was under attack was the blinding beam of the Leigh Light, followed within seconds by gunfire and depth charges. The first successful attack by an Allied aircraft with ASV and a Leigh Light was carried out on 5 July 1942, when a Wellington of RAF Coastal Command sank the U-502. During June and July of 1942, there were twenty attacks at night against surfaced U-boats by RAF Coastal Command aircraft fitted with ASV and Leigh Lights.[47]

Successful attacks by Allied aircraft in the Bay of Biscay resulted not only in the sinking of U-boats but also in lengthening the time required for U-boats to cross that body of water. On 24 June 1942, Doenitz ordered that U-boats proceed submerged and only surface to recharge their batteries owing to 'the extreme danger of air attacks in the Bay of Biscay.'[48] It did not take the Germans long to figure out that the Allies were using airborne radar to attack U-boats on the surface at night. The Germans installed on U-boats a device called *metox* to detect radar transmissions on frequencies from 2.5 meters to 53 centimeters. The result was a sharp drop in night attacks on U-boats by aircraft. The Allies then nullified *metox* by producing the ASV Mark III set, which operated on the frequency of 10 centimeters and which the German device could not detect. The Germans then countered with *naxos* which could, if conditions were satisfactory, detect the transmissions of an ASV Mark III set. The Allies next introduced the ASV Mark VI, which operated on a frequency of 3 centimeters.[49] The battle between Allied airborne radar sets and German radar detection devices during the Battle of the Atlantic was a contest for technological superiority between German scientists and engineers and their Allied counterparts.

The Allies were for the most part quicker to employ scientists to solve technological and operational problems than were the Germans. Civilian scientists at-

43. Elliott, *op. cit.*, pp. 517-27, gives a set-by-set account of all the various types of radar, direction finders, and radio telephones used by the Allies.
44. Roskill, *War at Sea*, I, 358-60.
45. Johnson, *op. cit.*, p. 203.
46. Cf. Alfred Price, *Aircraft versus Submarine* (Annapolis, Md., 1973).
47. Johnson, *op. cit.*, pp. 214-18.
48. Doenitz, *op. cit.*, p. 234.
49. Johnson, *op. cit.*, pp. 218-19.

tached to operational commands did what was called 'operational research,' using scientific methods to solve operational problems. RAF Coastal Command's operational research team was led by Prof. P. M. S. Blackett and worked not only on radar problems but also on such problems as at what depth air-dropped depth charges should be set to go off, what was the optimum size of a convoy, and what was the best color to paint aircraft engaged in hunting U-boats.[50] Unlike the Germans, operational research on the Allied side was represented at the highest levels of government. Blackett, for example, was a member of the cabinet's Anti U-Boat Committee, which was the highest British authority on the subject.

To have aircraft working with the surface escort of a convoy greatly strengthens the defense of a convoy from U-boat attack. Obviously, aircraft can sink a U-boat on the surface with bombs, gunfire, rockets, and depth charges; but equally important, aircraft force U-boats to submerge. World War II U-boats were not true underwater craft, as are present-day nuclear submarines. A World War II U-boat operated best on the surface and was capable of staying under water only for a limited period of time. German U-boats in World War II could steam at 17 knots on the surface, but while under water a U-boat could make only 2 or 3 knots. German wolf-pack tactics called for a convoy to be located and then shadowed by a U-boat while other U-boats were alerted to attack the convoy. To get into a position favorable for attacking a convoy, the shadower had to maintain contact with the convoy while the attacking U-boats made high-speed runs along the flanks of the convoy during the daylight hours in order to be in position to attack the convoy at night. Aircraft carrying out searches around a convoy can not only sink U-boats but also force them to submerge, and a submerged U-boat cannot keep up with even the slowest of convoys, much less get ahead of the convoy into an attacking position. Moreover, if the shadower is forced to submerge, she will lose contact with the convoy. Allied aircraft making searches and sweeps in front of a convoy, along its flanks, and behind it for several hours would, if nothing else, force U-boats to submerge and lose contact with the convoy. It was the ability to force U-boats to lose contact with a convoy as well as their ability to sink U-boats that made aircraft of such importance in the defense of convoys during World War II.

RAF Coastal Command used aircraft in two ways to defeat German U-boats. The first was to provide aircraft to escort convoys. The other was to attack U-boats in the Bay of Biscay as they traveled to and from their bases in France. Most of RAF Coastal Command's effort went into attacking U-boats during their passage through the Bay of Biscay. This was done because very few of RAF Coastal Command's aircraft had enough range to operate over the mid-Atlantic. Even though attacks on U-boats in the Bay of Biscay were not very effective when compared to operations over convoys in the mid-Atlantic, RAF Coastal Command, because of the limited range of most of its aircraft, had to choose between conducting operations in the Bay of Biscay or grounding most of its anti-U-boat aircraft. An additional incentive was that RAF Coastal Command was receiving cryptographic intelligence on the movements of U-boats in the Bay of Biscay.[51] It was for these reasons that RAF Coastal Command chose to undertake a major effort to find and sink U-boats in the Bay of Biscay. Sir John Slessor, who commanded RAF Coastal Command in 1943, described what came to be known as the Bay Offensive in terms of a tree, with the U-boat transit routes in the Bay of Biscay being the tree's trunk. RAF Coastal Command was to cut down this tree by patrolling the Biscay transit routes and sinking the U-boats as they came through the Bay.[52] The trouble with the strategy of patrolling the Bay of Biscay was that it took an enormous amount of flying time to sink a single U-boat, and it never prevented all the U-boats from passing through the Bay. During 1943, for instance,

> In the three months September to November, although the hours flown on escort in the area were steadily *reduced* and totalled less than one-seventh of the hours flown on patrol, the transit area air patrols accounted for four U-boats, air escorts for 15. In other words, while one kill on patrol absorbed 4,020 patrol hours one kill on escort and support absorbed only 160 hours.[53]

Also, the sinking of a U-boat in the Bay of Biscay did not prevent those U-boats that escaped from RAF

50. P. M. S. Blackett, 'Operational Research: Recollection of Problems Studied, 1940-45,' *Brassey's Annual: Armed Forces Year Book* (London, 1953), pp. 88-106; Ronald W. Clark, *The Rise of the Boffins* (London, 1962).

51. Hinsley, *op. cit.*, II, 231.
52. John Slessor, *The Central Blue* (New York, 1957), pp. 464-538.
53. *The Defeat of the Enemy Attack . . .*, 1A, 24.

Coastal Command's patrols from sinking ships in the Atlantic.

During World War II, not a single ship sailing in convoy was sunk when the escort was comprised of both aircraft and surface escorts. The Allies knew this, but for a number of reasons it was not until mid-1943 that they were able to provide air escort for convoys in the mid-Atlantic, in what was known as the 'air gap' or 'Greenland Air Gap,' known to the Germans as the 'black hole.' This failure was owing not to a lack of resources or ability, but rather to the Allies' inability to allot the necessary aircraft of the right type to close the air gaps in the Atlantic. Before Pearl Harbor, RAF Coastal Command obtained a small number of B-24 Liberators from the United States, and it was found that by removing armor and the self-sealing from the fuel tanks, and 'with minimum armament' these aircraft carrying 1,500 pounds of depth charges had 'an operational range of 2,600 nautical miles' which would enable them to operate as air escorts for convoys in the mid-Atlantic air gap.[54] If enough of these modified Liberators, known as very long range (VLR) aircraft, had been based in Northern Ireland, Iceland, and Newfoundland the mid-Atlantic air gap could have been bridged. But because of conflicts and misunderstandings between various Allied commands and commanders, it was found to be nearly impossible to obtain B-24's to convert into VLR aircraft.

One of the problems was that the commanders of the RAF and USAAF would not transfer, when possible, any aircraft suitable for strategic bombing to anti-U-boat operations. But the Bomber Barons were not the only problem, for in the United States armed forces the whole question of land-based aircraft for anti-U-boat operations was the subject of a huge disagreement between the navy and the army air force.[55] Further, after the end of the U-boat offensive along the American east coast, at the beginning of 1942, the Americans would not redeploy anti-U-boat aircraft away from the western Atlantic even though Allied intelligence knew that there were very few U-boats operating in regions patrolled by American aircraft. In February 1943, for example, United States aircraft flew 26,067 hours on anti-U-boat operations in the Eastern and Gulf Sea Frontiers without sighting a single U-boat.[56] The United States Navy from time to time would also remove without warning American naval anti-U-boat aircraft in Britain from command of RAF Coastal Command.[57] And RAF Coastal Command would not relieve a number of Liberators from operations in the Bay of Biscay for conversion into VLR aircraft suitable for operations in the mid-Atlantic.[58] This incredible confusion between various Allied commands almost cost the Allies victory in the Battle of the Atlantic.

In 1943 the air gap south of Greenland and the gap on the Britain-West Africa convoy route were closed by an odd assortment of means. For example, in the spring of 1941, the British began to mount fighter aircraft on merchant ships to protect convoys en route to Sierra Leone and Gibraltar from being shadowed by FW-200's which directed U-boats to convoys. Known as CAMS, these ships had mounted on them a catapult and a single Hurricane fighter aircraft. When an FW-200 made contact with a convoy, the Hurricane would be catapulted from the merchant ship, shoot down the German aircraft, and then ditch near the convoy so that one of the escorts could pick up the pilot.[59] Later in the war the British put into service a class of ships called merchant aircraft carriers, which were large bulk carriers such as tankers and grain ships with flight decks mounted on them from which four Swordfish aircraft could operate. The first merchant aircraft carriers went to sea in 1943. Nineteen of these vessels were put into service, but after 1943 when the U-boat crisis had passed, they were used to ferry aircraft from America to Britain.[60] However, all of these methods to get aircraft to escort convoys were only halfway measures. The real answer was for convoys to be covered by an escort group that had an escort carrier.

The Allies knew how effective escort carriers could be in convoy battles from the success of HMS *Audacity,* the Royal Navy's first escort carrier, before she was sunk in a battle on the Gibraltar-United Kingdom route.[61] Although the Americans and the British had a number of escort carriers in service it was not until

54. Public Record Office, AIR/20/1065, Minute by VCAS, 18 May 1943; Memo to c-in-c Coastal Command, 31 May 1943.

55. Morison, *op. cit.*, I, 237-38.

56. Public Record Office, AIR/20/2570, AOC-in-C Coastal Command to RAFDEL parts I-II, 19 May 1943.

57. Slessor, *op. cit.*, p. 512.

58. Morison, *op. cit.*, X, 43n.

59. *The Defeat of the Enemy Attack . . .*, 1A, 90-91.

60. R. C. Bayne, 'Merchant Ship Aircraft Carriers,' *Journal of the Royal United Service Institution* (November 1947), 92, 548-53; Public Record Office, ADM/205/56, Joubert to Pound, 2 November 1941.

61. *Roskill, The War at Sea*, I, 477-79.

March 1943 that an escort group built around the escort carrier USS *Bogue* began protecting convoys in the North Atlantic from U-boat attack.[62] The reason usually given for not assigning escort carriers to escort convoys in the North Atlantic is that these vessels were needed to support the Allied invasion of North Africa.[63] However, of the 15 escort carriers commissioned into the U.S. Navy and the 10 into the Royal Navy only 7 were involved in the invasion of North Africa.[64] During the last months of 1942 and the first months of 1943 American and British escort carriers were for the most part employed in activities which had nothing to do with the Battle of the Atlantic. Most of the American escort carriers were in the Pacific and the British escort carriers were undergoing 'reconversion' in British ports and it was not until May 1943 that the British escort carriers HMS *Archer* and *Biter* began operations in the North Atlantic.[65] In the case of the American-built British escort carriers the Royal Navy's Director of Naval Construction had good reasons for 'reconverting' the ships to Royal Navy standards: HMS *Avenger* after being hit by one torpedo went down with the loss of all but 17 of her crew and HMS *Dasher* was destroyed in the River Clyde by a gasoline explosion that killed 378 men.[66] The best that can be said about the Americans sending the bulk of their escort carriers to the Pacific is that it shows a lack of understanding of the importance of the Battle of the Atlantic.

With the end of the U-boat offensive in American coastal waters and the Caribbean, Doenitz deployed U-boats in the mid-Atlantic, where he thought they would be out of the range of Allied aircraft, to attack convoys running between North America and the British Isles. Doenitz decided on this deployment for German U-boats because it permitted them to carry out wolf-pack attacks without having to contend with Allied anti-submarine aircraft.[67] However, during December of 1942 and January and February of 1943, with a daily average of more than 40 to 50 U-boats operating against convoys sailing between North America and the British Isles, the Germans did not achieve much. In December of 1942 the Allies lost 61 ships, 19 of which were in convoy and 7 of which were stragglers from convoys. In January 1943 only 15 ships in convoy were sunk by U-boats. And in February 1943, out of nine convoys with a sum total of 242 ships that were attacked by U-boats, only 34 ships were sunk, amounting to 19 percent of the total number of ships under convoy that month. The convoys' escorts sank 12 U-boats, which is a rate of exchange of about one U-boat for every two Allied merchant ships sunk.[68]

One of the reasons why the U-boats did so poorly in the last month of 1942 and the first two months of 1943 was that the weather in the North Atlantic was extremely bad. It was more than bad weather and ill luck, however, that accounted for the U-boats' lack of success during this period. Time after time U-boat patrol lines, even though the Germans were reading Allied convoy codes, would just miss making contact with convoys or make contact in such a way that it was very difficult to attack the Allied ships. Further, when they managed to attack a number of convoys in February, the ratio of U-boats lost to Allied ships sunk was not in the Germans' favor. What U-Boat Command did not know was that the Allies were reading German naval codes and then routing convoys around the ends of U-boat patrol lines.[69] U-Boat Command thought that the Allies were obtaining their information from spies or that their codes were broken. Doenitz had German naval intelligence turn U-boat headquarters upside down looking for spies. U-boat ciphers and codes were checked many times, and the head of German naval intelligence stated each time 'that it would be impossible for the enemy to decipher them.' After numerous security checks, Doenitz was forced

62. Morison, *op. cit.*, X, 77.
63. Roskill, *The War at Sea*, II, 201.
64. HMS *Avenger*, *Biter*, and *Dasher*, USS *Sangamon*, *Chenango*, *Suwannee*, and *Santee*. Roskill, *The War at Sea*, II, 464-66.
65. USS *Long Island*, *Core*, and *Charger* were being used to train aircrews in American coastal waters. USS *Copahee* (commissioned 15 June 1942), *Nassau* (commissioned 20 August 1942), *Altahama* (commissioned 15 September 1942), *Barnes* (commissioned 20 February 1943), *Prince William* (commissioned 9 April 1943), and *Breton* (commissioned 12 April 1943) were all sent directly to the Pacific. USS *Sangamon*, *Suwannee*, and *Chenango* after the North African invasion were also sent to the Pacific while USS *Santee* after North Africa operated in the South Atlantic. USS *Card* (commissioned 8 November 1942) was first used operationally to carry troops and aircraft to Casablanca and did not undertake anti-U-boat operations until July 1943. The British American-built escort carriers HMS *Archer* (completed 17 November 1941), *Biter* (completed 5 May 1942), *Tracker* (completed 31 January 1943), *Battler* (completed 31 October 1942), *Attacker* (completed 30 September 1942), *Hunter* (completed 9 January 1943), *Chaser* (completed 9 April 1943), and *Stalker* (completed 5 March 1942) took no part in escorting convoys through the Greenland Air Gap during the last months of 1942 and the first months of 1943. Stefan Terzibaschitsch, *Escort Carriers and Aviation Support Ships of the U.S. Navy* (Annapolis, Md., 1981), pp. 32-35, 38, 40-50, 52-53, 55, 61-67, 193-94.
66. Morison, *op. cit.*, X, 39n.
67. Doenitz, *op. cit.*, pp. 337-47.
68. *The Defeat of the Enemy Attack* . . . , 1A, 90-91.
69. ACI, II, 4-30.

to conclude that the Allies were locating his U-boat patrol lines 'by means of [their] very long-range airborne radar. . . .'[70]

At the beginning of March 1943, the Allies held the Atlantic Convoy Conference in Washington. This conference, attended mainly by American, British, and Canadian staff officers and experts on anti-submarine warfare cleared up a large number of technical problems and misunderstandings among the Allies and brought a degree of rationalization to the war against U-boats. During the Convoy Conference at the suggestion of Adm. Ernest J. King, commander in chief of the U.S. Fleet and chief of naval operations, who did not approve of mixing forces of different nationalities, the North Atlantic was divided into British Commonwealth and United States regions of responsibility: Britain and Canada would be responsible for convoys north of the fortieth latitude while the U.S. Navy would be responsible for the protection of convoys south of that latitude.[71] This division of labor set the stage for the Canadian armed forces being granted command responsibility for the Northwest Atlantic theater of operations.[72] The new command arrangements agreed to in March of 1943 resulted in a much clearer demarcation of responsibilities between Americans, British, and Canadians for the conduct of the Battle of the Atlantic.

Doenitz and the German U-boats had already lost what was known as the 'tonnage war' by March 1943. Doenitz calculated that if German U-boats sank 700,000 tons of Allied merchant shipping a month, the U-boats would win the Battle of the Atlantic because the Allies would be losing ships faster than they could be replaced. These calculations were made without an understanding of the industrial capacity of the United States. Doenitz and other members of the German navy were blinded by the success of the second 'happy time' in American waters and failed to see that no matter what they did, the U-boats simply could not sink merchant ships faster than the Allies could build them. By the end of the summer of 1942, the United States alone was building merchant ships faster than the combined efforts of all the Axis powers could sink them. In the first quarter of 1943, new Anglo-American merchant ship tonnage produced was 1.5 million tons over what was being sunk in that period. For the rest of the war, new shipping tonnage never fell below 2 million tons over what was being lost.[73] Although the Germans did not realize it at the time, by March 1943 they could no longer win the war simply by sinking Allied Merchant ships. The only way that U-boats could win the Battle of the Atlantic after February of 1943 was to prevent the Allies from moving ships back and forth across the Atlantic between Britain, the Mediterranean, and North America. Operations by U-boats in distant oceans such as the South Atlantic and Indian Ocean were useless, even though U-boats did sink a number of Allied merchant ships in these regions, for they could not sink enough tonnage to offset new Allied construction.

In March 1943, the Allies lost 73 ships proceeding under convoy, and air and surface escorts sank 6 U-boats. This seemingly large number of merchant ships sunk while in convoy actually amounted to only 11 percent of the ships in convoys that were directly threatened with attack by U-boats; while 80 percent of those ships sailing independently were sunk when attacked by a U-boat. From the Allied point of view what was important was that although the ratio of ships sailing in convoy which were sunk had not increased, the number of ships sailing under convoy had increased. The biggest Allied losses in the North Atlantic in March 1943 took place when Convoys SC 122 and HX 229 lost between them 40 ships in the gap where the Allies could not provide air cover.[74] During March 1943, there were 179 U-boats operating at various times against convoys in the North Atlantic, and Convoys SC 122 and HX 229 were attacked over a three-day period by some 40 U-boats. March 1943 marked the period when the Allies lost the largest monthly number of ships in convoy since the beginning of the war. But it has to be realized that more than twice the number of ships were proceeding under convoy in March than were in February of 1943 while at the same time U-Boat Command had the largest number of U-boats operating against North Atlantic convoys since the beginning of the war. In February 1943 new U-boats entered the North Atlantic at a rate of about 1 per day. In April the number of U-boats operating against convoys in the North Atlantic had dropped to about 90. The larger number of U-boats

70. Doenitz, *op. cit.*, pp. 324-25.
71. Morison, *op. cit.*, X, 19-20.
72. W. G. D. Lund, 'The Royal Canadian Navy's Quest for Autonomy in the North West Atlantic, 1941-43,' *The RCN in Retrospect, 1910-1968*, James A. Boutilier, ed. (Vancouver, 1982), pp. 138-57.
73. Terry Hughes and John Costello, *The Battle of the Atlantic* (New York, 1977), p. 218.
74. *The Defeat of the Enemy Attack . . .*, 1A, 191.

operating in March 1943 did not alone account for the high Allied shipping casualties that month. There was at this time a lag of about two days in reading German U-boat radio transmissions by the Allies. Another reason was a lack of air cover over Convoys SC 122 and HX 229 because RAF Coastal Command had only 15 VLR aircraft of which only about 8 were operational at any given time.[75] And finally, according to the United States Navy's OP-20-G, German communications intelligence 'probably cost us the worst convoy defeat or at least played an important part in obtaining contact. (HX 229-SC 122).'[76]

March of 1943 was the last time during World War II that German U-boats were successful in mounting large-scale wolf-pack attacks on Allied convoys in the North Atlantic. In fact, although neither the Germans nor the Allies realized it at the time, by the end of March 1943 the German U-boats were on the verge of defeat. March saw the first use in the North Atlantic of a support group built around an escort carrier, when a support group including the escort carrier USS *Bogue* escorted Convoy SC 123 through the North Atlantic air gap. The concept of support groups dates back to September 1942, when a number of escort groups based in Iceland, the British Isles, and Newfoundland were given the task of reinforcing a convoy's escort when it was under heavy attack. Unlike convoy escort groups, however, a support group did not remain with a convoy; it was the task of the support group, after defeating an attack on a convoy, to remain in the area and hunt down and sink those U-boats responsible for the attack.[77] The addition of an escort carrier to a support group gives the force greater flexibility and much more hitting power. March also saw the Americans, British, and Canadians agree on a plan to deploy additional numbers of VLR aircraft in the North Atlantic air gap.[78] Escort carriers and VLR aircraft would not be decisive in March, April, or May of 1943, but when the U-boats resumed attacks on North Atlantic convoys in the autumn of 1943 they were key to totally defeating the German effort.

During April and May of 1943, German U-boats using wolf-pack tactics attempted, without much success, to attack Allied convoys in the North Atlantic. The U-boats found that it was extremely difficult to locate convoys because the Allies were using communications intelligence to route convoys around U-boat patrol lines.[79] But when the U-boats did find an Allied convoy in the North Atlantic, they found that convoys had become very difficult and costly to attack. In May of 1943 41 U-boats were sunk, and air and surface escorts of convoys accounted for 25 of the 41 U-boats sunk. During the attack on Convoy ONS 5, for example, U-boats sank 11 merchantmen, but at a cost of 6 U-boats. This is a trade-off of a little more than 1 U-boat lost for every 2 merchant ships sunk.[80] These high losses were brought about by the growing skill of Allied surface escorts and the increasing use of both VLR and carrier-based aircraft. Time after time U-boats were forced to break contact with a convoy and submerge because of the approach of Allied aircraft. In addition to the 41 U-boats lost in May 1943, many more were damaged by depth charges dropped by surface and air escorts. No force can continue to sustain the number of casualties that the Germans were suffering in the North Atlantic while attacking Allied convoys in April and May of 1943. On 24 May, Doenitz admitted defeat and ended operations against Allied North Atlantic convoys saying, 'Our heavy submarine losses in the last month are to be traced back predominantly to the present superiority of enemy location instruments and surprise from the air which is possible because of that.'[81] The Allied defeat of U-boat operations against Allied convoys in the North Atlantic was a direct result of increased use of aircraft, superiority in equipment and technique, and communications intelligence.[82]

On 30 May 1943, Adm. Ernest J. King, USN, established the 10th Fleet 'under the direct command of Cominch, to exercise unity of control over all U.S. antisubmarine operations in that part of the Atlantic under U.S. strategic control.'[83] The 10th Fleet, which did not have any ships directly under its command, was set up to centralize all matters relating to the

75. Public Record Office, AIR/20/848, Air Ministry to RAFDEL, 25 March 1943; Air Ministry to RCAF, 25 March 1943; RCAF to Air Ministry, 26 March 1943; RAFDEL to Air Ministry, 26 March 1943.

76. ACI, II, 46-52; IV, 59. The definitive account of this action is Jürgen Rohwer, *The Critical Convoy Battles of March 1943* (Annapolis, Md., 1977).

77. Roskill, *The War at Sea*, II, 201.

78. Library of Congress, Arnold Papers, Box 274, Minutes of the 76th Meeting of the Combined Chiefs of Staff, 19 March 1943; Public Record Office, AIR/20/2569, Joint Staff Mission to War Cabinet, 29 March 1943; RAFDEL to Air Ministry, 29 March 1943.

79. ACI, II, 101.

80. *The Defeat of the Enemy Attack . . .*, 1A, 93.

81. ACI, II, 78.

82. Ibid., II, 101.

83. Morison, *op. cit.*, X, 23.

American effort against German U-boats.[84] One of the advantages enjoyed by the 10th Fleet because it was commanded by King, who was commander in chief of the U.S. Fleet and chief of naval operations, was that it could issue orders directly to any command of the U.S. Navy without having to pass through the usual chain of command. The 10th Fleet, being in receipt of all intelligence concerning German U-boat activities, had the knowledge and ability to act quickly, directly, and decisively.[85] Before the 10th Fleet was established, convoy routings, escort tactics, deployment of aircraft, intelligence, and all other measures required by the U.S. Navy to fight the Battle of the Atlantic were divided up among various sea frontiers, fleets, squadrons, task forces, and other commands with the result that the American effort against German U-boats was at best an ad hoc undertaking. The 10th Fleet rationalized the American effort and gave the Americans the ability in terms of intelligence and command and control to take the offensive against the Germans in the Central Atlantic.[86]

When Doenitz broke off the pack attacks on Allied convoys in the North Atlantic on 24 May 1943, he ordered the U-boats to operate in an area southwest of the Azores.[87] Doenitz ordered this concentration of U-boats southwest of the Azores because it was the last remaining area in the Atlantic in which U-boats could operate against convoys using wolf-pack attacks without fear of attack by land-based aircraft. Perhaps Doenitz also thought that convoys running between the United States and the Mediterranean would not be as heavily defended as those in the North Atlantic.[88]

In the first major convoy battles in the Central Atlantic, the Germans failed miserably. The U.S. Navy knew from communications intelligence that the Germans had knowledge of the routes of Convoys Flight 10, GUS-7A, and UGS-9 in the Central Atlantic. The Americans also knew from communications intelligence the location of a patrol line the Germans had set up to intercept these convoys. What the Germans did not know was that the Americans were going to use escort groups built around escort carriers to fight the U-boats in the Central Atlantic.[89] Convoy GUS-7A and Flight 10 were routed around the southern end of the U-boat patrol line, and just before Convoy UGS-9 reached the German patrol line, aircraft from USS *Bogue* attacked in rapid succession three U-boats, one of which—U-217—was sunk, and punched a hole in the U-boat patrol line through which Convoy UGS-9 passed without being attacked. The German patrol line was reformed several more times in an attempt to intercept United States-Mediterranean convoys, but the Americans, knowing the location of these patrol lines, routed the convoys around their northern or southern ends.[90]

With the failure of wolf-pack attacks against American convoys in the Central Atlantic, the Germans next turned to a strategy of dispersal. U-boats were sent to distant seas, such as the Indian Ocean, the Caribbean, West Africa, and the South Atlantic to carry out attacks individually against Allied shipping. German U-boats of the 500-ton and 700-ton classes, however, required refueling at sea if they were to operate at great distances from their bases in France; and U-Boat Command, when it changed from wolf-pack attacks to a strategy of dispersal, did not give enough thought to this problem. The change from pack and patrol line tactics to dispersal was done to prevent groups of U-boats from being attacked and sunk by aircraft, but ironically resulted in increased vulnerability to air attack. Because of the short range of a large number of U-boats in the German navy, many of them had to be refueled at sea from U-tankers, which resulted in a lot of U-boats on the surface going to or from the U-tanker or standing by near it. In the summer of 1943, the Americans decided to direct the weight of their attacks against U-tankers and the U-boats being refueled from them.[91] The Americans reasoned that if the U-tankers were found and sunk, then the short-range U-boats would have greatly reduced operational ranges.[92]

The Americans planned to use communications intelligence to locate U-tankers and the U-boats they were supplying in the mid-Atlantic and then to attack the German vessels with aircraft from escort carriers. By June 1943, the Americans had the ships, aircraft, and information required to carry out this operation

84. Operation Archives, Naval Historical Center, Washington, D.C., 'History of the Anti-Submarine Measures Division of the Tenth Fleet.'
85. Kenneth Knowles, 'Ultra and the Battle of the Atlantic: The American View,' *Cryptologic Spectrum* (Winter, 1978), VIII, 14.
86. Ladislas Farago, *The Tenth Fleet* (New York, 1962).
87. Doenitz, *op. cit.*, p. 341.
88. ACI, II, 107.
89. William T. Y'Blood, *Hunter-Killer: U.S. Escort Carriers in the Battle of the Atlantic* (Annapolis, Md., 1983).
90. ACI, II, 104-7.
91. Ibid., II, 108-10.
92. Ibid., II, 114.

against U-tankers. Although there was fear in some quarters that sinking the entire German U-tanker fleet would lead the Germans to suspect that their codes were broken,[93] the U.S. Navy decided that this risk was worth running; for if the U-tankers could be destroyed, it would not only reduce the area in which U-boats could operate but also would throw U-Boat Command's plans for operations in the distant seas into total confusion.[94]

Four American escort groups built around the escort carriers USS *Card, Core, Bogue,* and *Santee* steamed back and forth across the Central Atlantic acting as a distant escort for United States-Mediterranean convoys while hunting and attacking U-boats. From June until the end of 1943, American carrier-borne aircraft and surface escorts, using communications intelligence, found and attacked scores of U-boats, sinking some 27 of them.[95] During the escort carriers' campaign in the Central Atlantic, a new weapon was introduced with the cover name of 'Mark 24 Mine' but unofficially known as 'fido' or 'wandering Annies.' Fido was an airborne acoustic homing torpedo.[96] Carrier pilots developed the tactic of forcing a U-boat to dive because of gunfire, bombs, or depth charges and then, as the U-boat was disappearing under the surface, a fido would be dropped into the vessel's wake.[97]

The American escort carrier operations in the Central Atlantic during 1943 completely disrupted German plans for U-boats to operate in distant seas. For example, an outward-bound U-boat would have to cancel its operation and instead refuel several U-boats which did not have enough fuel to reach France because the U-tanker that was supposed to refuel them had been damaged or sunk by the Americans. Time and again U-Boat Command had to change a U-boat's orders simply to be able to give other U-boats enough fuel to return to base.[98] Even without American escort carriers to hound and hunt them, by the end of 1943 the Central Atlantic had become a very dangerous area for U-boats; for in October 1943 the British constructed in the Azores an airfield from which long-range aircraft began to operate against U-boats in the Central Atlantic.[99]

93. F. W. Winterbotham, *The Ultra Secret* (New York, 1974), p. 86.
94. ACI, II, 112-14.
95. Morison, *op. cit.*, X, 107-29, 151-77.
96. Price, *op. cit.*, pp. 131-59.
97. Morison, *op. cit.*, X, 118-19.
98. ACI, II, 131-59.
99. R. E. Vintras, *The Portuguese Connection: The Secret History of the Azores Base* (London, 1974).

In September of 1943, Doenitz once again attempted, using wolf-pack tactics, to block the movement of shipping between North America and Britain. By 16 September the Germans had assembled 19 U-boats in a patrol line in the North Atlantic to intercept two westbound convoys. U-Boat Command placed a great deal of hope on being able to sink or beat off Allied surface escorts with acoustic torpedoes, which the Germans were using for the first time. This new offensive by the U-boats in the North Atlantic, which lasted into November 1943, was a total failure. The Allies quickly found the means to overcome the new German acoustic torpedoes.[100] The Germans found it increasingly difficult to intercept convoys because the Allies, using communications intelligence, were able to locate U-boat patrol lines and route convoys around their flanks. Moreover, by the fall of 1943 Allied surface and air escorts had finally shattered German hopes of ever being able to cut the North Atlantic convoy routes. The Germans, with an average of 60 U-boats at sea during September, October, and November 1943, sank 19 Allied ships, but at a cost of 52 U-boats.[101]

With the crushing losses inflicted upon the U-boats in the North Atlantic, Doenitz had to admit defeat. In fact, the German commander was forced to consider calling off the entire U-boat war because of the heavy casualties suffered at the hands of Allied warships and aircraft. On several occasions after the defeats of 1943, Doenitz and various senior U-boat officers considered stopping all U-boat operations; but each time it was decided to continue fighting a holding action or what amounted to a maritime guerrilla war. The reasons for this decision were simple. U-boats after 1943 could not win the war for Germany, but they could by continuing limited operations force the Allies to deploy hundreds of warships and aircraft hunting U-boats and escorting convoys. The continuation of U-boat operations would prevent the redeployment of these huge forces against Germany itself. Also, there was always the hope in Doenitz's and others' minds that some new device or weapon would enable the U-boat service to turn the tables on Allied anti-U-boat forces before Germany was crushed by the sheer weight of Allied military power. So the U-boat service fought on

100. National Defense Research Committee, *A Summary of Antisubmarine Warfare Operations in World War II* (Washington, D.C., 1946), pp. 161-76.
101. ACI, II, 168-84.

against great odds and suffered heavy casualties to the bitter end of the war. It surrendered as a defeated military force, but not as one which had been totally and absolutely crushed, as were the German army and air force.[102]

The Germans lost the Battle of the Atlantic in 1943 when their U-boats were defeated by Allied sea and air forces. The critical element that led to German defeat was the inability of the German navy, and especially the U-boat service, to overcome the Allied strategy and tactics of convoys and their support by superior intelligence and technology. Whether it be in the seventeenth or eighteenth centuries or at the time of the First and Second World Wars, the common historical lesson of the great maritime wars is the success of convoys in protecting merchant shipping.[103]

102. Doenitz, *op. cit.*, pp. 406-29.

103. *The Defeat of the Enemy Attack. . . .*, 1A, 228-31.

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Bryant, Sarah L.
Burgess, Martha
Carolina, Princess
Carver, Abbie
Chief, Indian
Chisholm, Mary F.
City, Quaker
Cleveland, President
Clinch, General
Cloud, Golden
Cloud, Silver
Coburn, Abner
Dauphin, Le
Davis, Lady
Dog, Black
Elizabeth, Queen
Flower, Sea
France, Queen of
Goodspeed, W. M.
Grey, James
Hare, George and
Hawk, Black
Helen & Mary
Hersey, S. F.
Hicks, Andrew
Hopkins, R. E.
Hume, Mary D.
Huntington, Samuel
Ironsides, New
Jacobs, Alice M.
de Lafayette, Marquis
Lawrence, St.
Lewis, William
Mallory, H. R.
Margaret, and Jane
Mar, Helen
Matthews, C. G.
Merchaunt, Royal
Morgan, Charles W.
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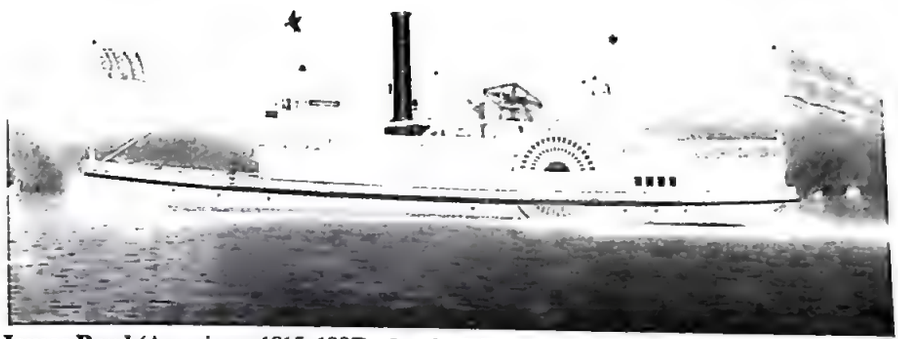
Mutine, La
Orcutt, H. Louis
Partridge, G. M.
Pendleton, Wealthy
Phebe, and Josie
Phoenix, Young
Pigeon, Cape Horn
Polly, Charming
Portal, West
Richard, Bon Homme
Ring, Blanche
Royal, Princess
Russell, Albert
Seabrook, William
Sparks, Sarah D.
Star, North
State, Keystone
State, Palmetto
States, United
Wasson, Nancy L.
West, Star of the

Captains, Ships, and Ports.



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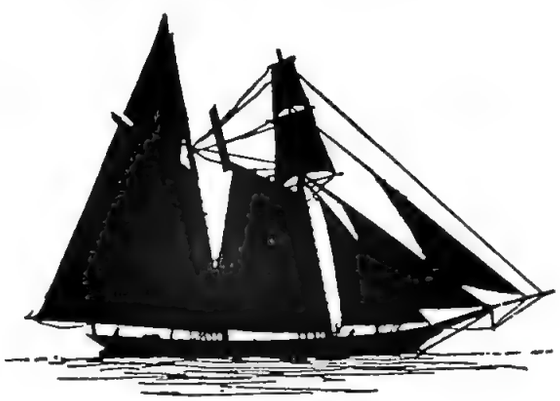

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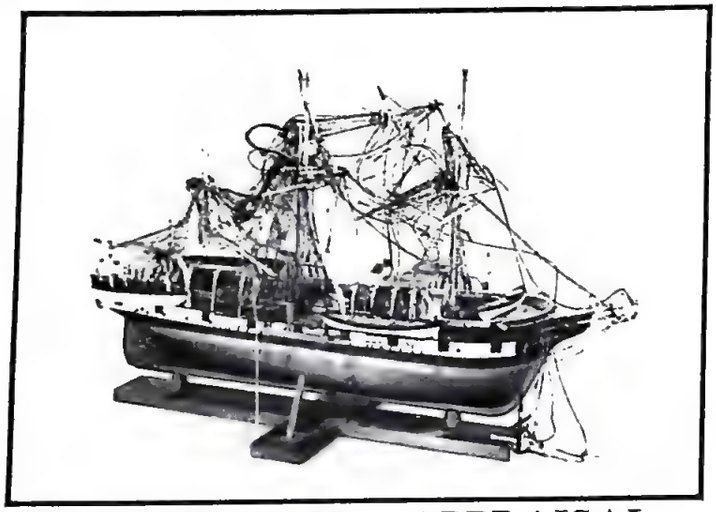

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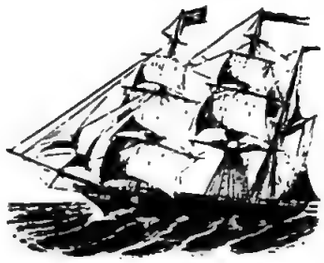

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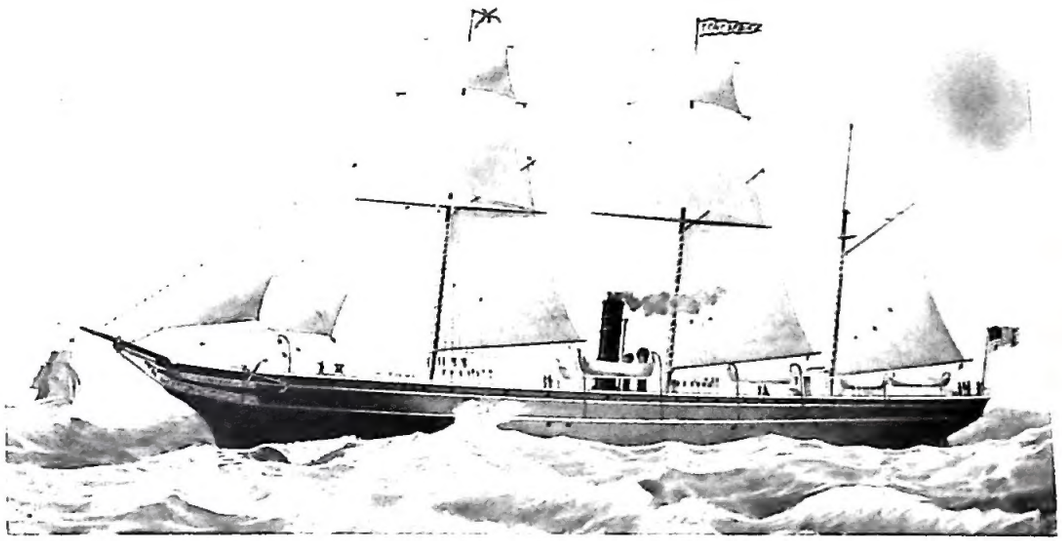

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